July 1960 / $1

ARMED FORCES management

PUBLISHED FOR THE ARMY, NAVY, AIR FORCE, COAST GUARD AND MARINE CORPS

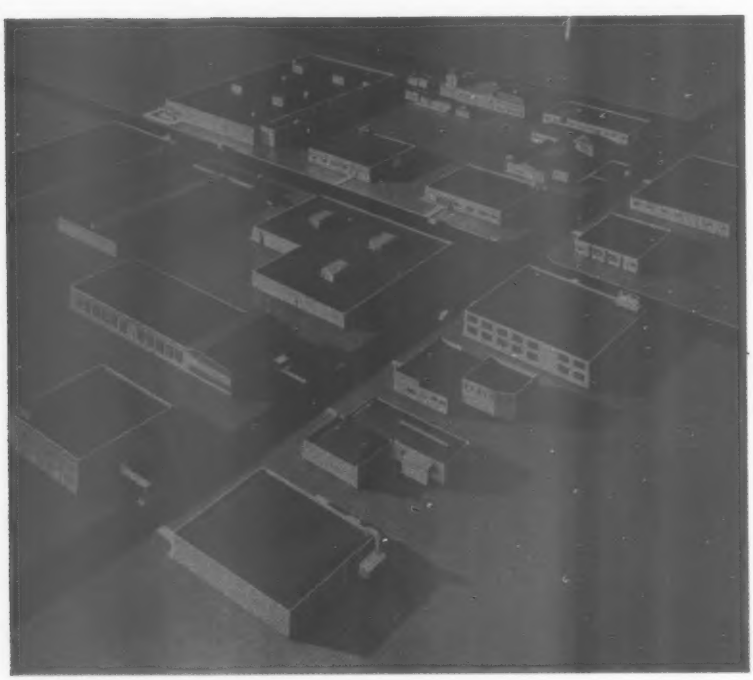
DEFENSE ELECTRONIC DATA PROCESSING ISSUE:

The glamour girl grows up . . .

LIBRASCOPE COMPUTER FACILITIES

Shown below is a composite view of Librascope's facilities where a variety of computer systems are currently in different stages of design and production. Some are strategically involved with national defense...others deal with business and industrial process control. Each is uniquely designed to answer a particular need. The success of these systems illustrates the value of Librascope's engineering philosophy: A decentralized organization of specialized project teams responsible for assignments from concept to delivery...and backed up by excellent research, service, and production facilities. For your computer requirements, call on the company whose breadth of diversification in computer technology is unsurpassed. ■ Librascope Division, General Precision, Inc., 808 Western Avenue, Glendale, Calif. For career opportunities write to John Schmidt, Engineering Employment. ■

computers that pace man's expanding mind



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ARMED FORCES management

JULY, 1960

PUBLISHED FOR THE ARMY, NAVY, AIR FORCE, COAST GUARD AND MARINE CORPS

Volume 6—No. 10

FEATURES

DEPARTMENTS

FEATURED NEXT MONTH

How Navy Handles its Research and Development . . . Value Analysis—Two Sides to the Coin . . .

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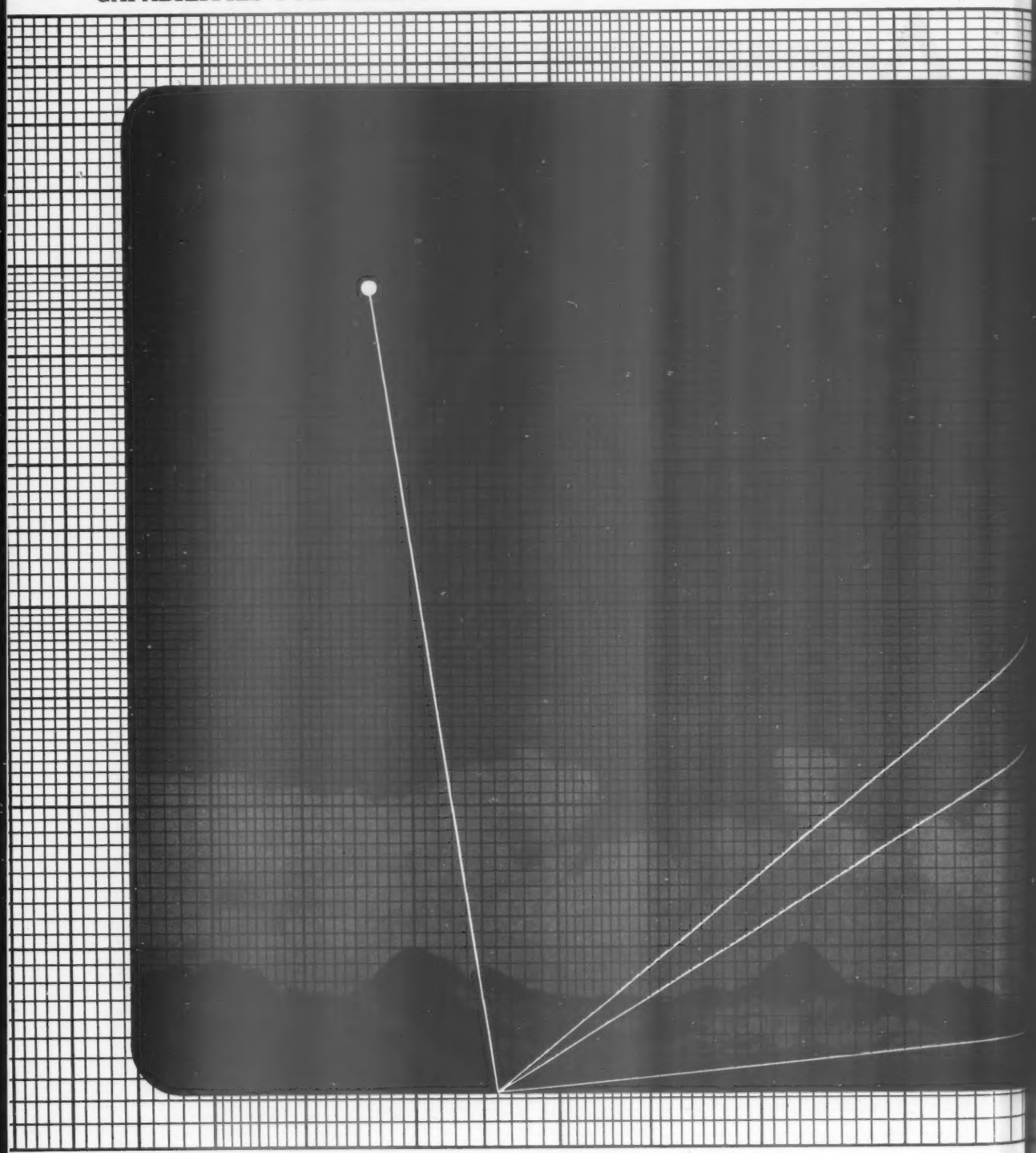
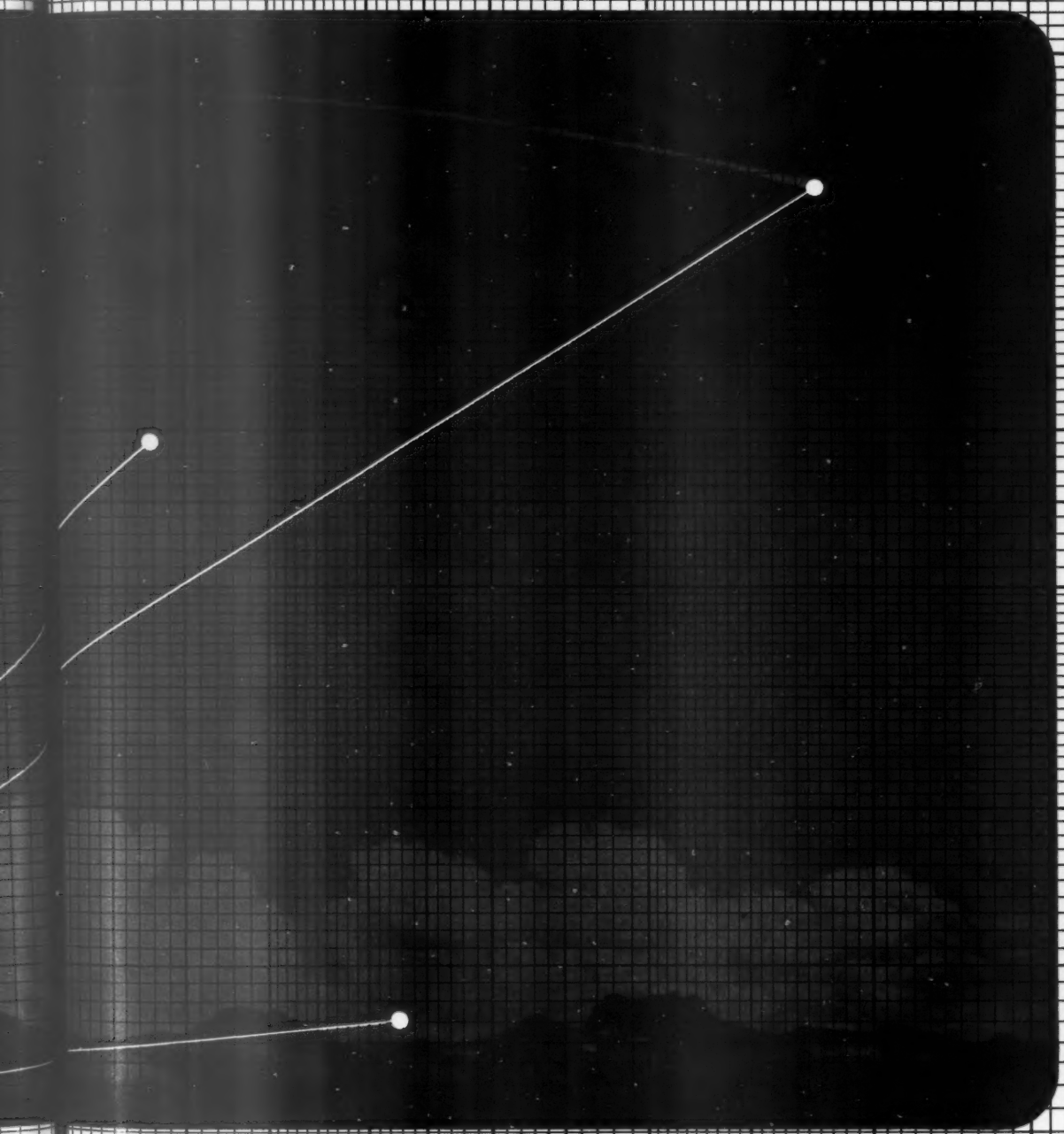


PRECISE MEASUREMENT IN SPACE... with New Westinghouse Radar Technique



An entirely new Westinghouse radar technique now under development at the Electronics Division will sharply increase the accuracy of radar detection, identification and tracking of objects in space.

Utilizing a single radar, the Westinghouse technique opens the door to many important new applications. Among them are accurate measurement of objects in space, satellite reconnaissance, air-to-ground surveillance and mapping and ground-to-air tracking and identification.

We would be pleased to discuss these new developments with qualified persons on a classified, need-to-know basis. Contact: Marketing Manager, Electronics Division, Westinghouse Electric Corporation, Baltimore, Maryland.

YOU CAN BE SURE...IF IT'S **Westinghouse**

J-02317

ARMY'S SD-1 RACKS UP 31 MISSIONS ...READY FOR 31 MORE!

At the Army Electronic Proving Ground, Fort Huachuca, Arizona, tough little SD-1 drones from Radioplane perform mission after mission training troops in the tactical use of drone aerial surveillance. Under the direction of the U.S. Army Combat Surveillance and Target Acquisition Training Command, they are launched and return with photo intelligence within minutes. The SD-1 serves our tactical organizations in the U.S. and overseas in Europe and the Far East.

Reliability is the keynote in Radioplane design whether the product is a tactical SD-1 drone like "Repeater," a target missile, or a landing system for a space vehicle.

PILOTLESS AIRCRAFT
FOR AERIAL SURVEILLANCE
FOR TARGET TRAINING
FOR WEAPON SYSTEM EVALUATION

RADIOPLANE
A Division of **NORTHROP CORPORATION**
Van Nuys, California, and El Paso, Texas

EDITORIAL

EDP: Trouble at the Top

TO A MAGAZINE concerned with the problems of the military decision makers, assembling a special issue on data processing, quizzing all the leading manufacturers of automatic equipment, talking to several score Defense Department persons who monitor or use the electronic machinery (hopefully) to help them do their job, can provide a short, intensive and very revealing education on the modern military businessman's environment.

It generated a high degree of admiration for a more than marginally successful pioneering effort by the biggest outfit in a business zooming into the future at least as fast as modern weapons development and probably faster. It also revealed some rather marked deficiencies in some of the bosses calling the shots.

Technologically, the business is moving so rapidly most of its members have trouble keeping track. Mountainous computations which once took months can now be done in the twinkling of an eye. Automatic supply inventory accounting of a maze of widely separated supply depots is routine in several spots today. It was an experiment just a year ago. Said one official, "You take a two week vacation anymore, you're apt to be out of date when you come back to work."

Defense has made a good many mistakes in trying to grow up with EDP and it will probably make a good many more. A portion can be discounted as inherent risks of pioneering. But we have one which can not—the managerial talents, or lack of them, in the COs who order EDP into use.

CERTAINLY, Defense is not the only indictable organization when it comes to executive weakness. But, being so big in the business that the twitch of one bicep is tantamount to a pitched battle elsewhere, the progress they devise is more spectacular—and the stumbles more sensational.

Unfortunately, the mechanical monster is moving far faster than many of the men who flip its ignition switch. We are paying precious little attention to developing the sort of executive in Defense who comprehends all the nuances of this revolution. Largely because of our shortsightedness, not all of what has been called data processing progress in the last handful of years really deserves the name.

Part of what we sometimes fatuously tag "managerial improvement" (often to ease our consciences about the buckets of money we are spending every minute) has actually been just transplanting old errors into a new medium. In effect, we can now make the same fumbles faster and more frequently.

Putting all of an installation's paperwork on a computer does not automatically mean we have integrated data processing. For that matter, some operations don't belong there at all. It's like hauling coal in a sports car.

We still collect data that nobody really needs to keep statistical track of jobs which really shouldn't be done, prepare reports on inconsequential occurrences in fields germane to the efficient functioning of nothing at all.

If the EDP revolution has done anything to top management, whether in the military or industry, it has placed a greater demand on intelligent decisions than we have ever been required to display before.

NO AMOUNT of effort, experience or success in working the bugs out of integrated data processing systems is going to circumvent the uninformed or uneducated executive performing in positions of high responsibility. In fact, his ability to foul up a situation is enhanced. The awesome capabilities of all this data processing hardware, while offering potentially amazing rewards, also threaten disastrous risks.

The danger, doubly great in defense, comes from that full quota of supervisors who dream up complex valueless tasks upon which to build an empire, the buck-passing neutralists willing to take a firm stand on only God, country and mother love, the unfathomly complex maze of negativist "coordination" channels, the franchised incubators for the nurture of the nit-pick.

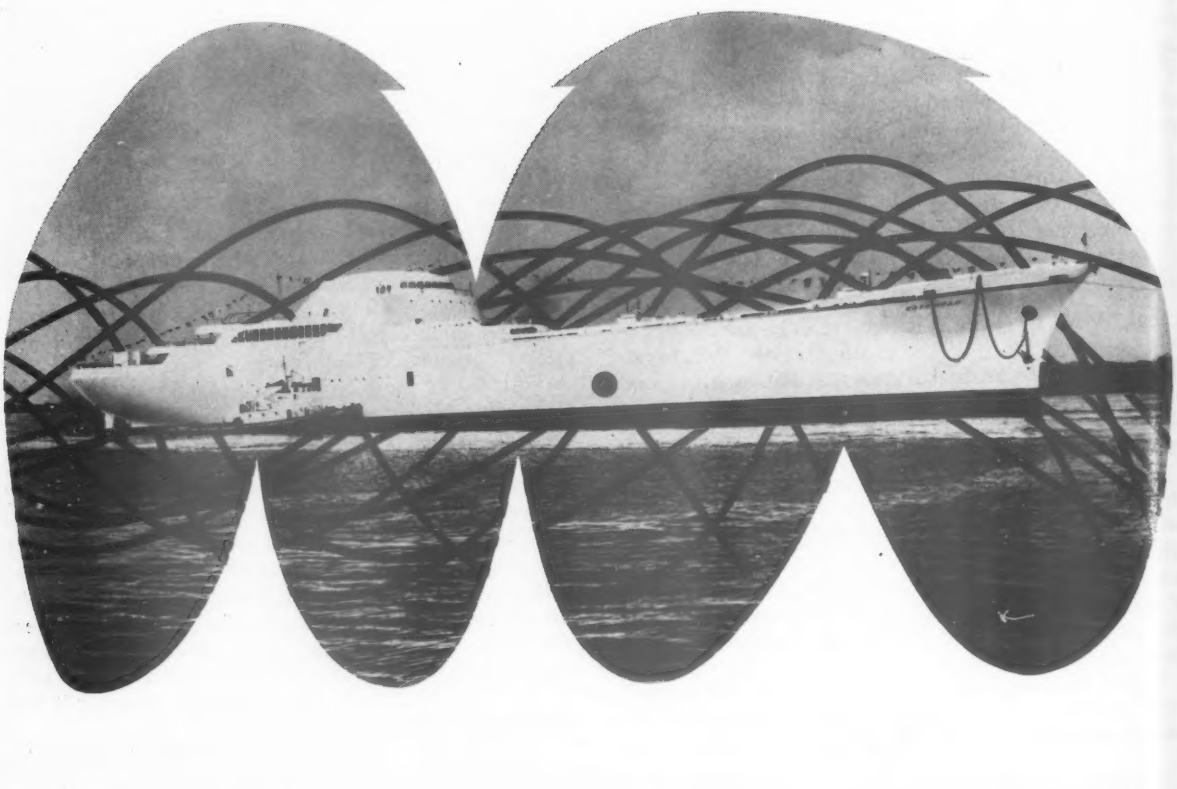
EDP makes possible the amassing of greater and greater amounts of information, makes possible the surveillance of more and more operations *in detail* by higher and higher levels of management. And this, is only one of the risks: That the boss will start running everything himself—with all its attendant degradation of the efficiency, effectiveness, the skill and morale of the men in the outer office.

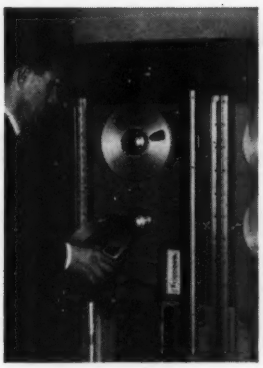
The hardware itself is not as much of an unblemished glamour girl as enthusiasm has described it in the past. It helps only the smart man. Unless we recognize this, our pioneering will become something a good deal less admirable, computerizing an operation will become synonymous with sterilizing it and we will indeed have let the hardware become the mechanical monster it was never supposed to be.

Bill Borklund

For the Babcock & Wilcox Company:

a Burroughs 205 computer backed the team that introduced atomic power to the merchant fleet...





another Burroughs computer is helping build one of the world's largest steam boilers...

and still another is speeding a vast research and development program

History has already earmarked July 21, 1959, in remembrance of launching the N. S. Savannah—the world's first nuclear merchant ship. This graceful queen of the seas may well be the precursor of a vast atomic merchant fleet—ships operating quietly and efficiently on nuclear engines.

Yet months before touching water, the Savannah's nuclear propulsion system was obtaining hundreds of "trial runs" on a Burroughs 205 computer at The Babcock & Wilcox Company's Atomic Energy Division in Lynchburg, Virginia.

Long before the vessel was launched these computer runs predicted changes that were to take place in the heart of the nuclear reactor. With the aid of these data, decisions were made as to the optimum size of the reactor, the lifetime of the fuel elements, amount of fuel needed, approximate costs and myriad other specifications.

Of course, a simulated run could have been made with a desk calculator—but it would have taken one year to complete a single run. The 205 has completed the same job in just a few hours.

This is the latest installment in a success story that started in November, 1955—the installation date of the Burroughs 205 at the Atomic Energy Division. Aside from the N. S. Savannah project, the same computer contributed immeasurably to other reactor designs, and other engineering work involving stress and thermal calculations, plus cost accounting data processing.

A recognized pioneer in the application of electronic data processing equipment, B&W was one of the first companies to develop its own automatic programming system. The effect of this powerful programming aid—called DUMBO—is to extend the capabilities of the 205 to hundreds of engineers without special knowledge of computer characteristics and techniques.

B&W engineers at Lynchburg are now able to write a plan for the computer to follow; DUMBO then automatically translates the plan into 205 language for electronic data processing.

With valuable 205 experience on design problems of a different nature, B&W's Boiler division (at Barberton, Ohio) has now installed a larger Burroughs 220 computer system to handle its increasing activities. Now in the design stage, with the aid of the 220, is one of the largest steam boilers ever conceived. When finally erected, the new steam boiler will stand as high as a 22-story skyscraper, produce 4,900,000 pounds of steam per hour, and generate sufficient power to light a city of 5,000,000 population.

Whether designing mammoth power equipment or a small industrial boiler, the Burroughs 220 has become a vital tool from initial bid through final design. The Burroughs 220 is helping to win orders with fast-but-realistic proposals, slashing costs and lead time at every possible opportunity.

B&W, whose product range includes tubular products, refractories, and marine boilers, as well as stationary steam generators, is also spearheading the development and construction of nuclear stationary and marine propulsion power plants. In all these programs, B&W depends upon the most modern analytical processing equipment.

At the company's Research and Development Center based in Alliance, Ohio, a third Burroughs computer has recently gone "on the air." This Burroughs 205 was purchased to process data for a variety of research experiments in the fields of heat transfer, fluid flow, stress analysis, and thermodynamics. Its immediate impact has been to free creative engineering talent from routine calculations and to reapply valuable human resources to the pursuit of new sources of economical energy. This 205 has already developed research data otherwise inaccessible.

All three Burroughs computers are helping B&W to meet a wide range of the nation's power requirements in the most efficient and economical way possible. Hundreds of other industrial and commercial users are confirming similar experiences.

Burroughs' complete line of electronic data processing equipment is backed by a coast-to-coast team of computer specialists, able to advise on how Burroughs can help you in your business. For additional information, write General Manager, Data Processing Systems Group, Detroit, Michigan.

Burroughs Corporation

"NEW DIMENSIONS/in electronics and data processing systems"

The sure hand of AE in Coordinating Communications

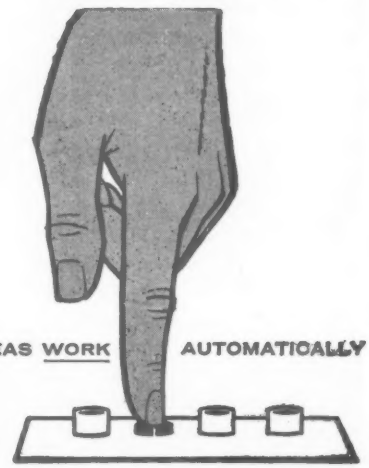
AE is an old hand at developing military communications devices and systems with unusual capabilities.

A prime example is the coordination device used in conjunction with the AE-developed automatic teletypewriter switching center.

Messages on punched tape arriving at a routing center are automatically given proper priority status... earmarked for single or multiple destinations and assigned to the first available open circuits for regional or global transmission to command centers.

Complex detailing and switching such as this is a logical extension of AE's wide experience in the design of complex circuit routing systems for automatic telephone exchanges.

If you have a tough problem in communications or control, AE can supply the answers – and provide the components or complete control systems to wrap it up. A letter or phone call (Fillmore 5-7111) to the Manager, Government Service Division, Automatic Electric Sales Corporation, Northlake, Illinois, will bring quick results.



AUTOMATIC ELECTRIC

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MAKING IDEAS WORK AUTOMATICALLY

Washington Background

BUDGET SQUEEZE IS HITTING MILITARY SUPPORT OPERATIONS OVERSEAS hard, if continued much longer may even affect mission capability. Squeeze is cropping up most significantly in personnel, parts availability, transportation, facilities.

EXAMPLE: THE WEARY, ANCIENT, BUT RELIABLE C-47, NEE GOONEY BIRD, is dying out in Europe through attrition. No money to buy new ones. No new, short-hop, light cargo aircraft are coming in to replace it. Result is a threatened sag in emergency supply of parts to combat planes, jump in the AOCP rate.

ANOTHER: 7TH ARMY'S BIG "LOGISTICS TAIL" THE COMMUNICATIONS ZONE, is setting an outstanding record in supply operations. But dependent children still are going to school, in some areas, in rag tag quonset buildings, dependent families (too many of them) are living "on the economy" in third rate housing billed at twice the rental charge to native Europeans.

ARMY'S COM-Z SUPPLY EFFORTS ARE REAPING RICH REWARDS, claim the men in charge, providing maximum control with minimum manpower. One statistic: In Ordnance Area, rated one of the most responsive commands, personnel issue over $1-million worth of stock a day, have control of some 32,000 items of supply, yet half the personnel in the operation are "lowest echelon French clerical help. Most can't even speak English." How good are they? Example: During Lebanon crisis, most supplies had reached ports of embarkation and arrival before the troops got there.

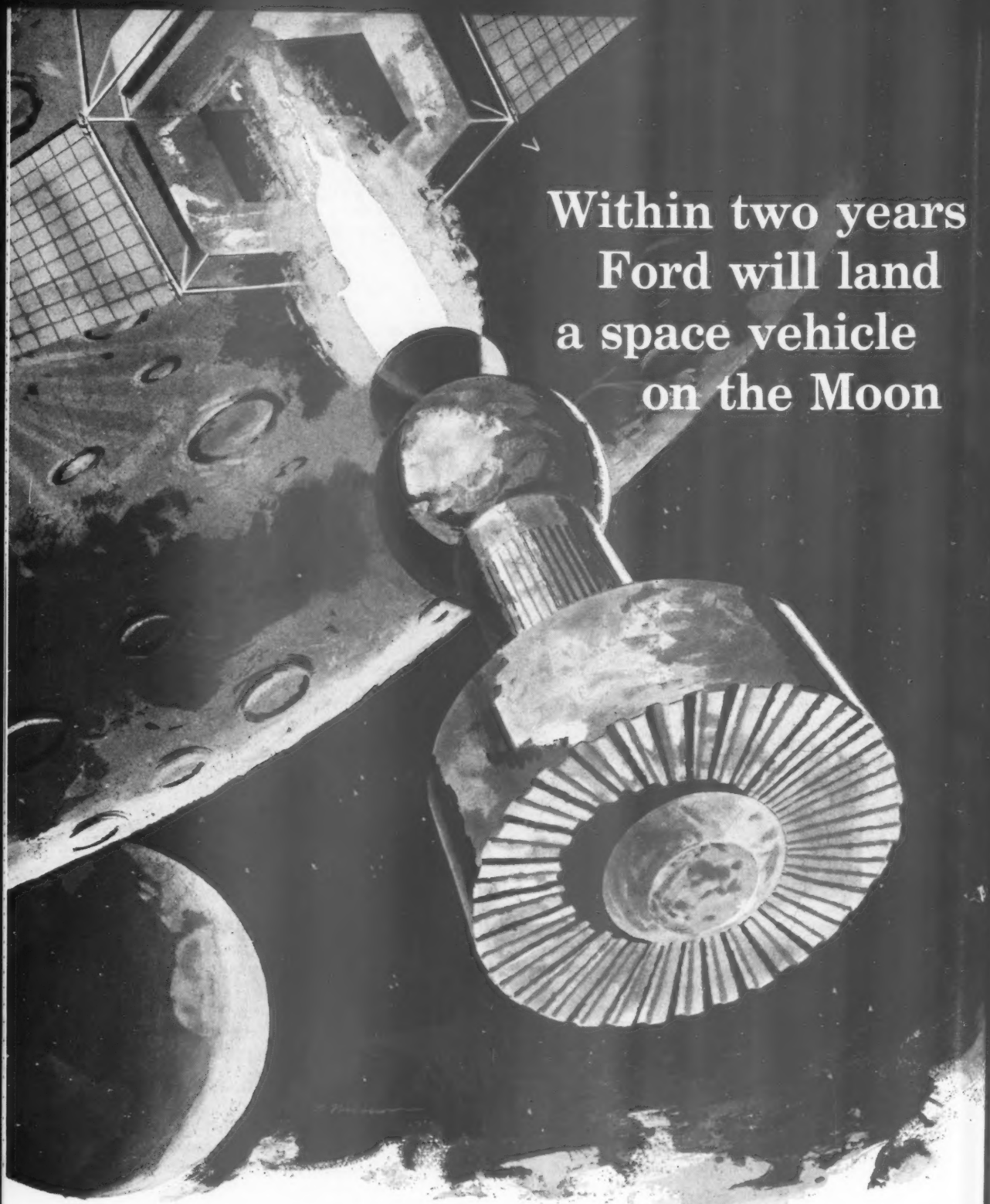
UNDER PRESSURE OF THE COLD WAR, North Atlantic Treaty Organization is jelling into what it was originally intended *militarily:* An alliance of nations in which each contributes what he is best capable of doing to a common military authority. Latest example: An attempt is well along to make air defense (until now an unrealistically national responsibility) an area arrangement of Joint Allied Air Forces.

GENERALLY, ALTHOUGH THERE ARE DISAGREEMENTS within NATO, at the *military* level there is a high degree of cooperation, mutual respect. Headaches come at higher levels where politics enter picture.

LONDON DEFENSE OBSERVERS ARE PREDICTING BRITISH will come up with a new defense policy, possibly within the next six months. Clues started coming with announcement of cancellation of Blue Streak. Said one caustic authority, "It's about time we did. We haven't had a policy since World War II, really." Observers are also predicting policy will revolve basically around an attempt to do "only what we are most capable of, not duplicating the same things every one of our allies is also doing."

INDICATIONS SHOW ALL NATO COUNTRIES MAY FEEL THE SAME WAY. One reason: A growing conviction the U.S. is in NATO to stay. Said one brash officer: "U.S. performance is convincing us I think. Justifiably or not, you had a reputation in Europe of going into something new in a big way, pulling out just when it looked as if it might pay off. We can't afford to take that chance with National Defense."

NOW-QUIET FLAP OVER GERMAN REQUEST FOR BASES IN SPAIN "should never have happened," said one SHAPE officer. NATO council was informed before German feelers went out to Spain, concurred in the objective. Idea, which military experts agree with (even in the nations which objected politically) is that training ranges, dispersal fields are hard to come by in Europe where real estate is at a premium, commercial air traffic is heavy, and weather is generally unfavorable for training efforts.



Within two years Ford will land a space vehicle on the Moon

A 300-pound Lunar Capsule containing scientific instruments will soon make a "rough" landing on the Moon. It will be carried by a larger spacecraft to a location about 25 miles from the Moon's surface, then released. A retro-rocket will cushion its impact. The Lunar Capsule will transmit vital scientific data back to Earth for a month or more. This unique space vehicle will be the product of Ford Motor Company's Aeronutronic Division.

In My Opinion

Admiral Disagrees

I read your editorial in the April issue of ARMED FORCES MANAGEMENT with interest and considerable concern. I feel that some of the comments expressed in your editorial reflected a degree of misunderstanding concerning our objectives in the use of the prenegotiation clearance as a management tool.

You are entirely right in saying that our topnotch negotiators, working closely with the procurement teams, plot a course of action beforehand. The rationale underlying our prenegotiation procedure recognizes this fact and, in a way, merely formalizes into policy and procedure what has been practiced informally in many of the past larger and more complex procurements.

We do not contemplate interrupting negotiations or requiring that the negotiator hold up contract negotiations to clear minor changes in the proposed contract and pricing arrangement. The requirement for clearing changes during the course of negotiations is aimed at major issues or policy aspects which we feel it is necessary to control. This is essential to the well being of our gigantic procurement job and is certainly good management practice.

We are taking vigorous steps to achieve cost reductions and other efficiencies wherever possible. We believe that having major points reviewed by a central reviewing authority in the Navy serves this purpose and assists substantially in obtaining sound procurement. Moreover, advance approval or clearance of the major aspects of the procurement plan will largely eliminate the previous time-consuming process of reopening negotiations where our reviewing authorities found it necessary to disagree. It is therefore expected that contract actions can be expedited by reviewing the plan of negotiation in advance on the larger procurements. Initial results appear to support this conclusion. As time goes on we expect to show indisputable evidence of improvement.

VAdm. E. W. Clexton
Chief of Naval Material

Senator Stimulated

I appreciate . . . the article entitled "Today's Military Strategy: Is It National Suicide?"

This is a very stimulating and provocative article, and think in many respects it has hit the mark.

In terms of over-all strategy of preventing nuclear attack on our country,

(continued on page 59)

TOP PLANNING GROUP SEEN

A single service National Defense Force has been proposed by Lt. Gen. C. S. Irvine (ret.), former Deputy Chief of Staff for Air Force Materiel.

Citing rapid technological advances as opposed to traditional military concepts, Irvine said such a National Defense Force would "provide operational and logistical flexibility so that the secretary of this defense force could assign military missions to appropriate commands and know that reasonable compatibility and capability existed. It would help eliminate duplication and parochial rivalry."

Irvine said such a force would allow a 50% cut in present DOD personnel and then "the 50% of the military in the Pentagon headquarters that spend their lives in frustrating coordination could then return to operations or logistics with the combat forces."

Irvine said, "I am suggesting here that we have within the Defense establishment a legally constituted board, authorized by Congress and integrated within the total defense procurement setup, to plan, recommend and direct specific actions regarding weapon system research, development, procurement and production."

SINGLE MANAGER NAMED

Secretary of the Army has been designated Single Manager for automotive supplies and for construction supplies.

Under the new assignment, Army will provide all three services with military automotive supplies which include such items as vehicular supplies and repair parts, tires and tubes, engine components and the like, and will provide military construction supplies which include repair parts for construction equipment, diesel engines and components, lumber and related construction items.

Agencies carrying out these assignments will be set up 1 June 1960, to become fully operational as soon as possible.

Also under Army responsibility will come decisions to buy, purchasing, cataloging, standardizing, distributing, and disposing of excess items in the system in these categories.

With the creation of these additional single managers, an integrated distribution system and uniform operating procedures are being developed to ease effective supply operations within the 8 single manager operations now established within the Defense Department.

A-PLANE FUNDS RESTORED

House Appropriations Committee has overruled the subcommittee decision to delete $58-million from Atomic Energy Commission's programed funds for aircraft nuclear reactors. It is in the reactor work that the nuclear powered aircraft program is having its greatest difficulties.

Committee spokesmen said "testimony taken by the committee shows that billions will be necessary to achieve ANP objectives. Prospective date for acquiring a useful aircraft is probably five to eight years in the future."

VINSON HEARINGS END

Hearings before the Vinson special House Armed Services Procurement Subcommittee have come to a close, with Defense Department stating that the Vinson bill to amend procurement laws would slow down military equipment purchasing, increase costs and create confusion in the weapons programs. DOD also said that detailed contracting information proves the worth of incentive contracting.

But in spite of this, Vinson concluded the hearings with instructions to his staff to work out "guidelines" detailing limits on the use of incentive contracts. He said a way to inculcate real incentive provisions and eliminate "bonuses" that are now awarded merely because the target price was too high in the first place must be found.

Stating the Defense Department position, Assistant Defense Secretary (Supply and Logistics) Perkins McGuire said DOD strongly opposes a clause to limit incentive payments to those contractors who can clearly demonstrate cost savings are due to their "skill, efficiency or ingenuity." McGuire said DOD wants all possible reductions and not just those described in the bill.

He said, "If we limit our sharing of cost reductions to those as to which such proof is possible, many other cost reductions would never be made because there would be no incentive for the contractor to make them."

McGuire said the Defense Department agreed with the subcommittee's proposal to establish as the intent of Congress that all purchases should be made by formal advertising whenever it is feasible and practicable. He said Defense is now revising its regulations to this end.

J. Edward Welch, deputy general counsel for General Accounting Office, told the subcommittee that agency generally supports provisions of the Vinson bill (HR 12299). He said the incentive contract is one type that "caused considerable difficulty in establishing fair and reasonable prices."

EMERGENCY FUNDS SEEN

The Senate Appropriations Committee has reported out a Defense money bill containing over $1-billion more in money for the Defense Department than the Administration originally asked for.

Recommended—and supported with funds—in the report were: (1) re-instatement of the B-70 bomber program; (2) speedy development of a reconnaissance satellite; (3) emergency-type funding for Atlas and Titan—to be used as needed—rather than increases in either of those programs.

Included in the Committee bill was $162-million in additional funds for Army modernization, $66-million extra for Navy aircraft and missiles, and $613-million in extra money for Air Force procurement.

Part of Navy's development money will go for development of a Vertical Take Off and Landing assault transport and further work on the Eagle/Missileer programs.

Advanced Research Projects Agency money amounted to $215-million, largely for Project Defender and propellent chemistry.

In voting the money for the B-70 program, the committee noted "This will be enough to provide the necessary funds to progress with the development of a fully modern, supersonic manned bomber. Without these funds as provided by the committee this development program would have been delayed for several years."

Calling it a matter of national emergency to move forward as rapidly as possible on a sound reconnaissance program, Senators added $83.8-million to the Samos program. This, in the committee's words, was enough to "accelerate to the maximum degree possible research and development efforts on the Samos reconnaissance satellite program." Senators felt that this money would be enough to chop nearly a year from the development time needed for an operational version of the sky-spy.

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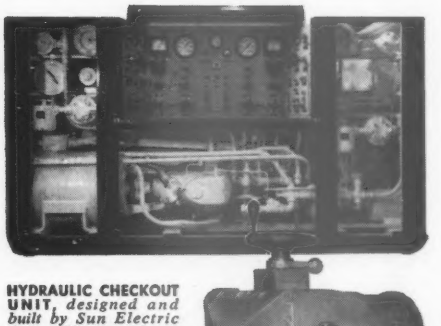
Flexible, high-accuracy simulation with DENISON hydraulic pump power for...

CHECKOUT



HYDRAULIC CHECKOUT UNIT, *designed and built by Sun Electric Corp., Chicago (shown with access panels removed) is powered by a Denison 800 Series Variable Volume Piston Pump—shown below with handwheel control.*

With Denison Variable Volume Axial Piston Pumps powering your hydraulic checkout equipment, you assure *high-accuracy simulation.*

These pumps (with volumes to 116.7 gpm and pressures to 5000 psi) allow a wide range of pressures and flows to be selected with fine-line variations. You get the multi-purpose flexibility needed for today's checkout equipment.

Denison Variable Volume Piston Pumps—and *all* Denison hydraulic components—are precision manufactured for long, maintenance-free life. Result—you can spend more time checking-out... less time checking-up.

Ask your Denison Hydraulics Specialist—located in all principal cities—to show you how Denison hydraulic equipment—pumps, motors, valves, controls—can help you improve the performance of your GSE systems.

Write for your copy of new Bulletin 204, "Advanced Hydraulic Components For Ground Support Equipment"

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Enlarging Glasgow Air Force Base... CAT DW20Gs strip 2 million cu. yd.

To accommodate SAC B-52 Bombers, the taxiways and aprons at Glasgow Air Force Base, Montana, had to be enlarged. The 8700-ft. existing runway had to be widened and extended to 2½ miles long. Included in this contract were 1 million cu. yd. of select gravel, 500,000 cu. yd. of concrete aggregate and 350,000 cu. yd. of crushed gravel.

Getting at this gravel, lying under 7 to 12 ft. of clay, was a big job. Peter Kiewit Sons' Co. of Omaha, Neb., relied on five Caterpillar DW20Gs with big 482B Scrapers to quickly, efficiently strip the 2 million cu. yd. of overburden.

This powerful earthmover is ideal for this type of work. Its 345 HP turbocharged Cat Diesel Engine provides travel speeds up to 35.8 MPH. With optional SynchroTouch Transmission Control, the operator simply dials the desired gear for automatic, split-second shifting, up or down. It's the new, advanced way to shift gears faster and easier for quicker cycles, more yards per hour.

The big 482B LOWBOWL Scraper carries 24 cu. yd. struck . . . 34 cu. yd. heaped. It's built to handle the toughest loading and hauling conditions.

This fast-moving DW20G-482B combination takes charge of a broad range of applications. Field reports throughout the world confirm its high productive efficiency. In addition, this team gives you all the benefits of job-proved Caterpillar dependability. And your parts logistics are simplified by Caterpillar's world-wide dealer network, with complete parts stocks in every country of the free world.

Caterpillar Tractor Co., Defense Products Dept., Peoria, Ill., U. S. A.

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TOUGH MACHINES FOR THE HARD WORK

Electronics: key to the

secret sea

The problems posed in developing an effective Anti-Submarine Warfare System require the development of entirely new concepts in the broad field of electronics.

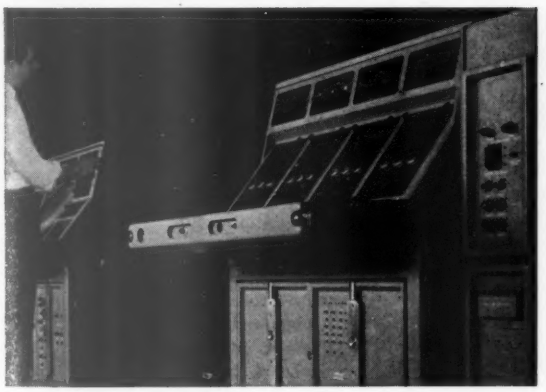
Applying electronics skills toward each of the many elements of the problem is only part of the job. The real key is in the integration of these elements into total systems that effectively solve the problems of ASW.

Working with the Navy, Hughes has instituted a complete systems analysis or "information environment" approach. This Hughes "systems orientation" draws upon unique abilities acquired in the development of such Hughes systems as: airborne electronics armament systems, which can control an entire mission; 3-dimensional radar systems, which constitute the most important advance in the state of the art since radar itself was invented; Falcon guided missiles, which are the most advanced weapons of their type—just to name a few.

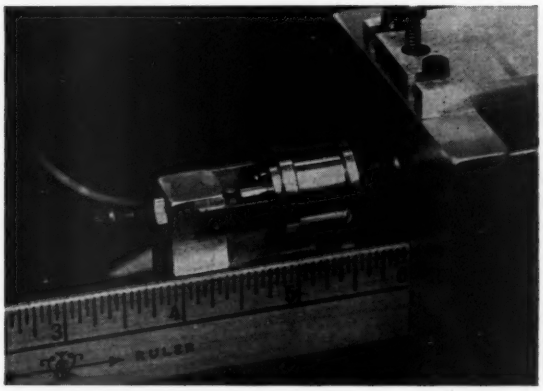
Rather than taking standard approaches to the ASW problem, Hughes engineers are using a wide variety of electronic disciplines. Studies presently underway include: research in acoustic array systems (both fixed and mobile); radar and IR detection systems; magnetic anomaly detection systems; information, command and controls systems for strategic decision-making and for tactical operations; communications systems; signal recovery techniques; human factors studies.

Foresight, imagination, tested and proven management capability—these are the factors which insure successful Hughes systems implementation. For further information concerning the Hughes "information-environment" approach, please contact: Mr. D. R. Heebner, Underseas Warfare Mission Coordinator, Hughes Aircraft Co., Fullerton, California.

This simulated Navy Combat Information Center uses Hughes advanced information and display systems to unite hundreds of pieces of surveillance data into a meaningful total.



To study ultrasensitive infrared systems for ASW, Hughes engineers have developed this prototype miniature super refrigerator which cools sensitive elements to temperatures as low as −260° C.



Creating a new world with ELECTRONICS

HUGHES

HUGHES AIRCRAFT COMPANY
Culver City, El Segundo, Fullerton, Newport Beach, Malibu, Oceanside, Santa Barbara and Los Angeles, California; Tucson, Arizona

How We Mismanage the Mechanical Mor

High level officials in the Defense Department, biggest business in the country and by far the best customer for EDP equipment, have been conducting, for nearly a year, a series of evaluations on just how well the mechanical brain is being used in military data processing operations. The exchange of experience information might help considerably in improving military handling of EDP except that the evaluations have also learned: "each installation seems to insist on making its own mistakes in this field, whether somebody else has already committed the same error or not."

THE WEAK SPOTS:

- **Manual procedures continue long after the machine has presumably taken over the job, i.e. there is a sort of mental "cultural lag" on the part of users.**
- **Information is put on the machine and it pumps out products and reports that have no business being done there.**
- **Machines produce more data than management can use, i.e. EDP ability to pour out reports is being abused.**
- **The military departmental Data Processing Program planning needs more top level attention, more cross-service coordination, and more work.**
- **Installation commanders too frequently seek authorization for a computer for to "keep up with the Jones" then because of any clear cut conviction that it will help them manage their operation better.**
- **EDP purchase requests almost consistently underestimate costs (primarily in programming and peripheral EAM areas) and almost as consistently overestimate savings.**
- **Quality of source information needs improving (best answer probably: mechanization of data preparation).**

THERE is nothing inherent in a computer that assures its effective use, Charles A. Phillips (see Pentagon Profile, this issue) told the Industrial College of the Armed Forces recently, "and our first concern must be to develop our own management capabilities to direct, control and effectively utilize this new tool and also to use it only where and when it is required."

Defense Department is easily the biggest user of data processing equipment for business, scientific and engineering applications—and is going to get even bigger. Some statistics: A year ago, 155 defense activities were operating 279 computers around the world. By fiscal 1961, Defense estimates the number of activities having computers will jump to nearly 300, the number of computers in operation to over 450. In the same time span, operating costs for computer installations (including operators, programmers, equipment rental, etc.) are expected to climb from $160-million to $225-million.

Just as explosive and even younger than the missile upheaval, data processing equipment use in the military is beset with all the growing pains of any mushrooming business. Some time back, key Defense officials felt enough had been learned here and there about how to effectively handle this mechanical monster so that it was time Defense took a look at where it was headed in the business and what must be done to improve equipment utilization. Result was a fairly formal evaluation process from which results are only now beginning to come in.

In a recent memorandum, W. Carl Blaisdell, Deputy Defense Comptroller, said: "There are two basic purposes in this evaluation: first, at the specific installation level, to determine the benefits derived from the use of the computers in terms of management improvement; the comparative costs of the ADPS; the extent to which the benefits and costs measure up to expectations; the purposes served by the products of the computer systems; and areas for corrective action and plans for the future.

"Second, from the Defense Department level, based on the information gathered in these reviews of specific installations, we hope to form some independent judgements regarding: the potentials for electronic data processing to achieve significant management improvements; the desirability for a concerted effort toward additional installations and expansion and modernization of existing installations; or, the need for a more deliberate and cautious approach to the approval of ADPS installations."

Criteria used for not only evaluations of equipment in use but also criteria for approval or disapproval of a request for new EDP purchase and installation are a matter of defene record. For this article's purposes, a quick look at some of the generalized evaluation findings will be of more benefit.

A good bit of this information has been outlined or suspected before. One weakness, a key element to success of the ADP program and one of the most elusive problem spots to pin down, is the apparent lack of attention to profiting by experience. This may account, to some extent, for the consternation an installation commander may feel when he is turned down on an EDP request "even though the commander down the road has a computer all ready to do the same job I want to do." The top level defense officials apparently pay more attention to this experience factor.

To too great an extent in the field, said one official, "experience amounts to realizing that the mistake we made yesterday is the same one we made last year." In any event, many of the weak spots in ADPS installations were pinpointed recently by Phillips. Among his observations: "While I would agree that generalizations are dangerous and sometimes misleading, there are some things that stand out quite clearly:

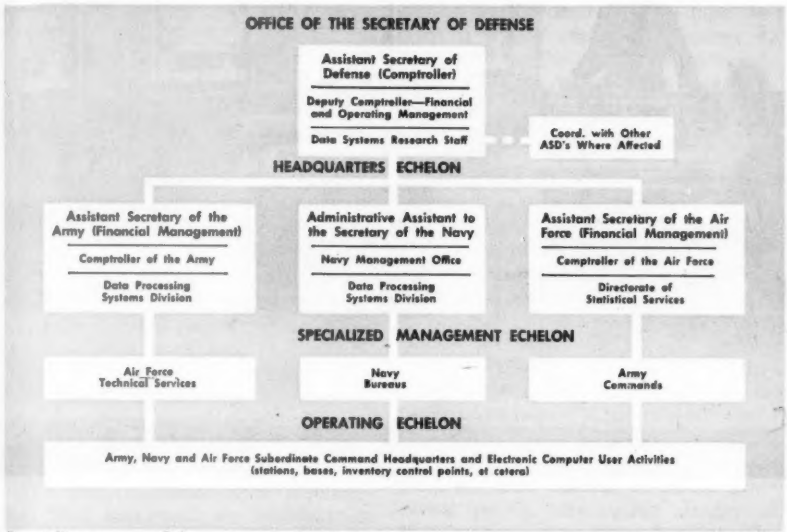
"Many defense computer installations have turned in excellent performance records, even though they have often not met the unrealistic targets initially set.

Buckshot Estimates

"With few exceptions, ADP costs have been underestimated in the proposals as compared with actual experience. Variance will run from 25% to 50%. The major cause seems to be due to an underestimation of the machine time required—jobs estimated to require 4 hours running time may take 8, 10 or 12 hours. Generally, the proposals assume a constant workload and

Moron

by Bill Borklund



Providing control from top to bottom . . .

this just doesn't happen—we don't have constant workloads.

"With rare exceptions, the writing of instructions or programs for the computer takes longer than was estimated—sometimes over twice as long. This runs your costs up for ADP programs. Cost is about three to five dollars per program step in defense—quite comparable to the reported average cost for industry. We are trying to do something about the cost of programming and its related problems." (See COBOL below)

"There is a failure, quite generally, to include all of the costs in the proposal. Something is usually overlooked—supporting equipment costs, some of the building modification or other installation costs, training, travel costs, and the like.

"While proposals underestimate the ADP system costs, they also generally overestimate the savings. The estimates frequently include fractional bodies to be eliminated—and you just can't eliminate fractional bodies. We have also found instances where manual or punch card operations were not discontinued even though the computer was duplicating the work and doing it faster and more accurately.

"There is a general failure to meet targets in the release of punch card equipment as scheduled in the proposal. I am convinced that the only sure way to meet such targets is to follow the practice of one department and schedule the discontinuance of the punch card equipment when the computer is approved.

"We have noted a failure to anticipate wage and rental increases—and we have had both in the past few years with adequate advance notice in most cases.

"There often is an excessive period of parallel operations—nine months instead of three, or three months instead of one. We find, too, that there has been a failure to recognize that systems development, together with computer programming, is a continuing job. You just don't stop improving the system and programming when you install the hardware.

"More serious than any of these is what I would call a preoccupation with the hardware, or a "get on the bandwagon" type of approach. In such cases, there is often a complete failure to make a systems study with the result that there is simply a substitution of a computer for the previous punch card equipment—with little or no change in the basic system. Under such an approach, the many advantages offered by the computer are lost or not fully utilized.

"In service center types of installation, where a single large computer is to serve various functional areas, we have found instances where the proponent operating activity failed to get the potential customers "in on the act" with the result that such prospective customers refused to utilize the facility.

"In some of the so-called "integrated systems" we have found some quite unprofitable applications which resulted from a mistaken idea of what "integration" really is, and the thought that if you put every data processing job on the computer, you have an integrated system—even though there is no relationship between some of the jobs or applications.

"There is a rather general failure to question the need for and the effective use of reports and other machine products with the result that "Parkinson's law" comes into operation and the work expands to occupy the full time of the computer.

"Now I have been talking about one side of the coin. It's not all bad—all computer applications are not unprofitable and all installations don't make every mistake in the book. There are a number of computer applications that are doing an excellent job of reducing direct administrative costs even though they didn't quite meet the original targets.

The Inflated Benefits

"We are also getting some significant management benefits from the use of computers. This is particularly true in the supply area, through improvements in supply reaction time and increased rates of the initial fill of requisitions. In the personnel area, we have been able to reduce personnel pipeline requirements through quicker personnel assignments.

"We are also getting indirect savings through inventory reductions although this is frequently the result of a combination of things and can't be attributed solely to the computer. (We had an instance in the performance evaluation of a depot where the total inventory being managed through the computer application had been reduced by over $60-million dollars within the first year after the computer was installed. The depot gave some credit for this reduction to the computer operation but when we brought this to the attention of our budget division, they said: 'The computer wasn't responsible for that—we cut the budget sixty million'.)"

(continued on page 66)

Keeping Track of People With EDP

Air Reserve Records Center must maintain vital service and mobilization data on over half a million Air Reservists. To keep this information current—and accessible on a near-instantaneous basis—ARRC has gone to the all-transistorized RCA 501 Electronic Data Processing System.

by Douglass M. Parnell, Jr.
Civilian Deputy
Air Reserve Records Center

ON NOVEMBER 12, 1959, a new dimension opened for personnel management.

On that day, the Air Reserve Record Center in Denver—one of the largest personnel centers in the world—placed in service its new fully-transistorized RCA 501 Electronic Data Processing System.

Pioneering with this new generation of EDP will automate the vital statistics needed to maintain the U.S. Air Force manpower bank of 535,000 reservists at peak readiness. And it will add a new order of speed to the center's primary mobilization mission.

The new computer will handle daily a monumental statistical, filing, and editing job. It will also let ARRC handle a steadily increasing workload without increasing manpower.

A measure of efficiency:

(1) Documents covering updated data files for 134,609 officers and 400,993 airmen not on active duty (that would stretch six miles end to end) will be stored on just 10 reels—24,000 ft.—of magnetic tape.

(2) Processing an average of four million pieces of mail a year pertaining to reservists' status will be speeded up to 17 minutes per 1000 inquiries—vs. 367 man-hours per 1000.

(3) ARRC will have ready access to data on reserve strength, skills and availability for the detailed reports to Headquarters, USAF, the Continental Air Command, Department of Defense and Congress.

(4) About 20,000 personnel record file changes will be processed daily, including audits for compatibility of reservist qualifications and status with assignments.

(5) The EDP System will identify individuals due for periodic personnel survey forms used to maintain Air Force Reserve mobilization potential. The system will address forms, control surveys, and provide follow-up mailing when needed.

(6) In assessing officers for promotion, the computer prepares a list of eligibles by grade; and, if the officer is promoted, enters the promotion on his magnetic tape file.

(7) The system prepares labels for 330,000 monthly copies of the *Air Reservist Magazine*, and 20,000 copies quarterly of the *Medical Training Bulletin*.

(8) Queries from such agencies as

Veterans Administration are answered on a same-day basis.

Selecting the RCA 501 followed a decision that automation was necessary for ARRC to fulfill its complex personnel management job. The Center promotes, assigns, retires, separates and discharges more than 90,000 reservists yearly. Each action must be recorded in the reservist's individual file and in the strength and availability reports affected by the change.

The Center began work in February, 1954 when records at eight locations around the country were combined at one location. At that time 240,000 records were kept in the file bank. By 1958, the number climbed to 432,357 and new ones were arriving at rate of 18,000 per month.

Paper Tidal Wave

Handling these records, the Center processes more than four and a half million pieces of correspondence a year. Most letters contain added information for individual records, or requests for information on reservists with records on file.

The first consideration is mobilization. Most important, the mobilization mission of the Center requires ready access to information such as reserve strength, skills and availability for reports to Headquarters USAF, Continental Air Command, and the Defense Department.

Doing this job well with existing staff became increasingly difficult. The workload had almost doubled in the five years since ARRC opened. There had been no personnel increase, workloads continued to grow, and timely action became more and more vital. These factors made it imperative to consider automation.

A feasibility study showed that a large scale electronic data processing system was needed to improve the maintenance of reserve personnel records and Center efficiency.

This study established that ARRC could: (1) Maintain current reserve records; (2) Reduce the over-all cost of operation; and (3) Provide services which could not be furnished at present.

Cost savings alone estimated in the study amounted to about $278,500 for each year of successful operation after the first year.

The new system was delivered eighteen months after planning of the installation began, and the Center is now converting many clerical procedures and all of its punch card files to the new system.

After careful study and analysis of six manufacturer proposals the RCA 501 EDP system was selected.

The RCA 501 system selected includes eight tape stations on-line, two modules (33,000 characters) of high-speed memory, a card transcriber, a transcribing card punch, and an off-line high-speed printer. The system accepts information from punched cards or paper tape, allowing the Center to use its present punched cards and to convert gradually to paper tape. The system can accommodate 63 tape stations if future expansion requires it. This will let the Center prepare address labels for *Air Reservist Magazine*, for surveys or for other mailings from information in the memory bank with no break.

ARRC studies show that input to a computer is a significant factor in any system. The Center therefore uses an integrated total system approach. All procedures were analyzed from data origination through final processing.

For example, the study revealed the Center prepares over a third of total orders affecting reservists. Using the total system approach (a tape could be punched at the same time an order was prepared. This tape then is used as direct input for the computer or punched card system to seven processing points, eliminating danger of transcription errors at each point. The 501 tape reader used with this system reads data directly into the computer at 1000 characters per second.

To support the total integrated system, the Center is in various stages of preparation in a number of major areas. Describing principal operations scheduled for the system may help other agencies considering automation.

Why Cards Failed

The first real challenge was to create a magnetic tape master file from punch cards. Limit of punch-card equipment underscored the need to develop strict audits while converting these cards. To compound the problem, each reserve officer had four basic cards: a classification card containing basic personnel data; a classification card with reserve promotion data; an address card, or cards; and finally, a special card created because of a recent punch-card audit.

Thus, the first step in the program was to convert the four card decks to magnetic tape and to perform an audit to identify duplicate cards, errors and so on.

The next step, and probably the most important one, was to merge the four tapes into a master file on magnetic tape. During this phase, a check identified missing cards by specific reservist, and prepared rosters for research to obtain missing data. Data passing the audit was merged and arranged in the format of the Center's permanent master file. This was the start of the Center's computer system.

A further check audited the master file to assure it contained specific data and to validate data compatibility. Besides the obvious audit which checks for missing items, compatibility checks are made in areas such as Air Force specialty code vs. flying status, or birth date vs. current grade. For example, it is obvious that a reservist born in 1940 should not be a colonel.

Because of these audits, the Center created an added work area, requiring that erroneous data be researched and integrated back into the file. To do this, corrective data is prepared as Status Changes, and fed into the computer during updating.

Like all basic programming systems, the conversion will be done in three major phases: Phase 1—Analysis: This consists basically of determining what data will be carried on magnetic tape and in what format it will be carried. It was decided to keep the master file in service number sequence. The cards then had to be analyzed for data available on specific cards, etc.

Programming and Testing

Phase 2—Programming: With the objective set, creating detail charts and writing actual programs began. Plugboard layouts had to be prepared for use in the Card Transcriber to convert existing punch cards to tape.

Phase 3—Program Testing: When the programs had been written, the last conversion phase involved testing. Program testing was divided into three major parts:

1. A Program Logic Test to see if the program is doing the job it should. Custom data was created on a small number of punch cards specifically to test various program paths.

2. A Unit Test, in which 1,000 actual punched cards from the old system, are run through each specific program in conversion. Over-all quality of the conversion system is checked by funneling the same data through all conversion programs.

3. A Systems Test, using data from 5,000 cards, volume insuring every possible type error in the card system will be encountered.

After all programs are tested, ARRC's EDP system will be ready to convert the entire card system.

With the master file converted, the next step is updating, consisting of three computer runs.

The first is to get input into computer format. Initially, all additions or changes are brought in by EAM cards. Additions consist of four cards, audited for completeness and validity. Those

Air Reserve Record Center Commander Brigadier General Julian M. Chappell has directed what is one of the most successful projects in ADP to date at his installation, handling half a million Air Reservist records in all matters from promotion to mobilization. The job is large, but today it is also much easier and more accurate.

passing the audit are the reservist's master file. If errors or incomplete information turn up erroneous data is written out for research. EAM cards will soon be phased out and replaced by paper tape.

The second run audits, prior to updating the master tape, all transactions for: (1) Format accuracy, including dates and items within the transaction. (2) Correctness of new information. (3) Logical reassignment.

This run identifies future transactions, holds them in sequence until the processing date, and combines transactions from the first run with feedbacks from other computer operations.

The third computer run is the actual updating. Provision is made for simultaneously extracting data from the master file by predetermined criteria, at the same time as updating and processing. Outputs from the run are an updated master file, extracts for further computer work and information for reporting.

Most Important Job

It is estimated that 20,000 changes will be processed daily during the three updating runs. All outputs are on magnetic tape, and all errors are edited and printed on the off-line printer for the research group. A similar updating system will be set up for the master file of Retirees.

After updating a reservist's file, it is audited for item compatibility. For example, a man assigned as a pilot is audited to be sure that his specialty code and flying status match his job. All master files are audited monthly.

Basic work on converting programs led to significant procedural improvements. Analysis showed many old codes would not adapt to a computer system. Many codes were revised, and accuracy improved. ARRC will now have a daily current file to perform its job.

The Center's most important mission is to maintain Air Force Reserve mobilization potential. The Air Force has identified critical positions and specialities to be manned by qualified reservists. Mobilization alignment can be done in minutes by running the master file through the system.

Inquiries about Air Force Reservists, mainly from the Center's staff, as well as from Air Force headquarters, Veterans Administration, Army, Navy, and Congress, can be answered daily.

To help keep up-to-date accurate information on Reservists, such as job changes, added skills, changed dependency or deferment, or changes in availability, the Center mails personnel surveys. The new data processing system will identify individuals to receive surveys, address the survey forms, and finally control the surveys, including follow-up mailings.

The system will also maintain complete records of reservist participation in various Reserve programs. Such participation credits toward retirement, and maintains the mobilization potential.

For the 27 status reports of varied complexity and volume required of ARRC, the computer will process the entire master file monthly, and extract all information needed. The system will also monitor changes in reserve strength and summarize them periodically.

The master file at the end of the month will be run through the computer and various information extracted to tape stations. Each output is processed through further computer programs which sort, compose parts of reports, and extract information for further processing. Up to 15 different reports could be put out on one tape station if they had the same sequence.

Another job similar to producing reports is printing over 300,000 labels for the *Air Reservist Magazine* each month, and 20,000 labels quarterly for the *Medical Training Bulletin*. Extracted monthly during master file updating are grade, name, AFSN, and address of each reservist who receives the *Air Reservist Magazine*. These are sorted by state, county, and city to put them in mailing sequence.

The extracted file is then divided into fourths and run back to the computer from four tape stations for editing to label format. Edited tape is placed on the high-speed printer, and labels are printed four abreast on paper 12 inches wide, perforated to give 3-inch labels.

On the selection board schedule set each year for each officer grade, the system produces, on demand, the officers eligible for consideration by grade. Rosters and control documents for board processing will also be produced by the system.

After voting by the Selection Board, rosters for EAM cards are prepared for Headquarters USAF or CONAC. With approval of board proceedings by Headquarters USAF and return of rosters with officers selected, the effective date of promotion for each officer and promotion orders are published and the master file updated.

The master file with information on all reservists is kept in service number sequence. To handle inquiries when only a name is known, the Center will set up a file on magnetic tape, by name and service number in alphabetical sequence. Screening the cross file gives the correct service number, to be fed back to the computer on an updating run, as a query for desired information.

Good Schedules or Chaos

Even after these programs are set up and productive, the job is not done. Constant modification will be needed as Air Force policy changes to meet new needs and challenges.

Keystone of integrated EDP is computer scheduling. Without synchronized scheduling, reports will not be current, query replies will be inaccurate, and Reserve participation credits may be invalid.

Scheduling computer hours is a painstaking task. It involves timing studies, workload studies by day and month, evaluation of peripheral equipment needs and constant rescheduling.

To maintain employee morale and good personnel relations, management has continuously kept the Center's people abreast of what is going on with the computer and electronic data processing. The new system created many jobs for which employees were given a chance to qualify. Stories on the computer ran in the base newspaper. Key personnel were flown to Camden, N.J., and briefed by the manufacturer on all phases of the system.

At the Center, a four-hour orientation was provided for supervisory personnel. A booklet, Electronic Data Processing and ARRC, was distributed to all personnel. An invitation to all personnel for a ten-hour briefing on the system brought 500 reservations. Three hundred and twenty-six employees—one-third of the Center's civilian personnel—attended the five two-hour briefings on their own time. Because of the careful orientation, complete cooperation has been received from the ARRC staff, and the changeover is proceeding on schedule.

Why Frustration at Fort Meade?

Perhaps no single ADP project has ever been more misunderstood than the current effort at Fort George G. Meade to achieve integrated, service center concept ADP at Class I Installation level. As is usually the case much of the criticism that has been leveled at the Meade project is without foundation, when taken in its true context. The pros and cons in this instance are not as black and white as they would seem to appear in the first look at the problem. With a thorough understanding of what is being done--a pioneering research job for both the military and industry--the story takes on a different aspect. This article tells why . . .

by Fred Hamlin

WHEN IT COMES right down to rumors, there is probably no single Automatic Data Processing project that has been more thoroughly raked over the coals than the Army's attempt to set up integrated data processing for a Class I installation at Fort George G. Meade, Md.

The reactions to the project range from smothered laughter to solemn headshaking, but there are few that are encouraging. Summed up, the standard comments—until recently—boiled down to four words: "They'll never make it."

As is usually the case when the rumor mill gets cranked up, things are not as bad as they seem. The reasons for the almost unbroken skepticism concerning the Fort Meade project are many, and of these at least a few have virtually nothing to do with what is actually going on.

Admittedly, Fort Meade has had its share of troubles. But in running a research project on specific applications of equipment in a field which is in many ways still a research project itself, not to have troubles would be unthinkable. The criticism that is being levelled at the Meade project is not basically different from criticism that has greeted many other major ADP installations in their early phases, and it is criticism that is compounded by factors which would seem to have practically no bearing on what is being done.

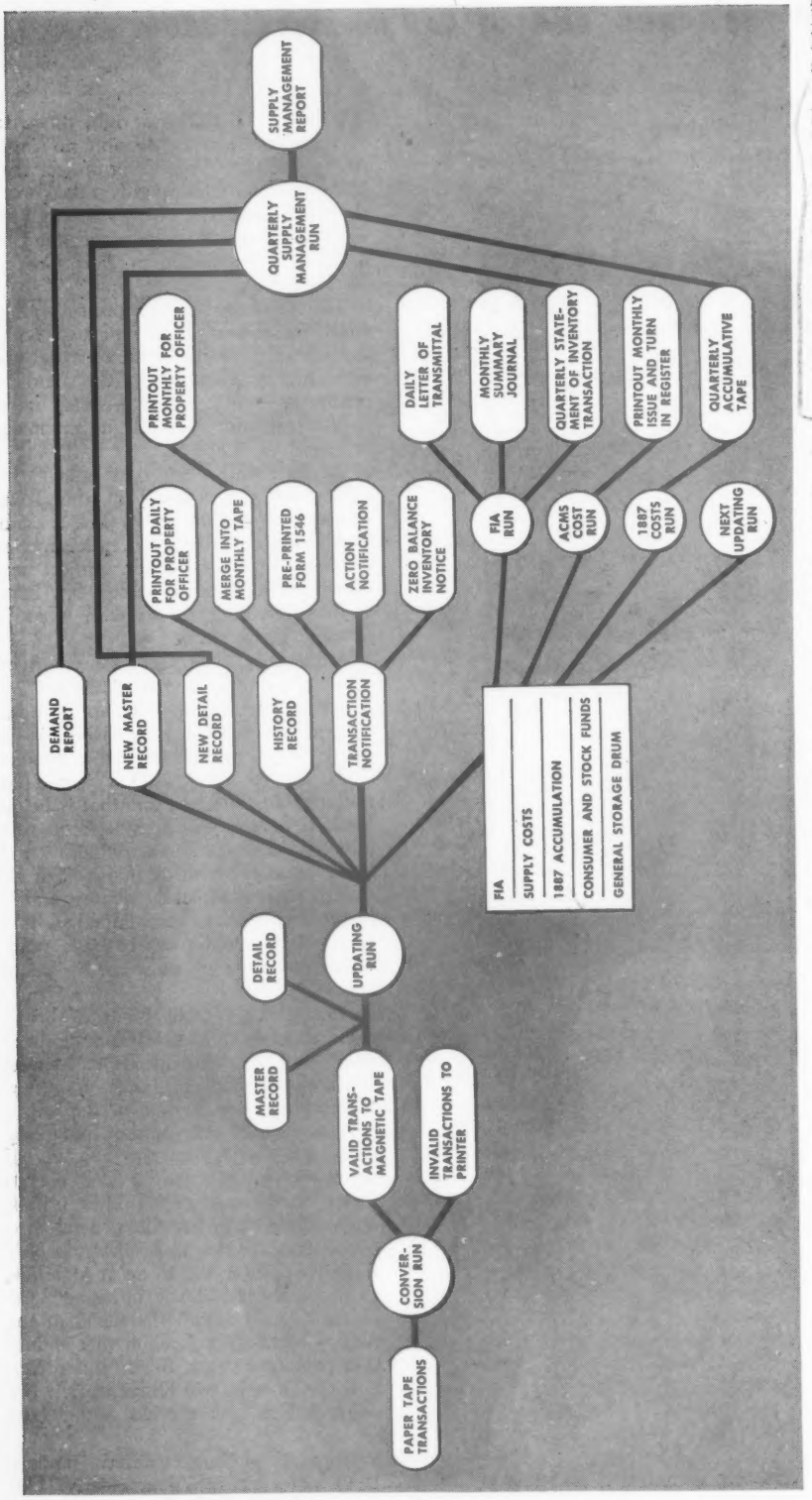
Among the reasons for rock-throwing: a general misunderstanding of what is being attempted at Meade; what was perhaps a slightly ambitious time-table given the size of the job; a fair share of the ever-present budgetary problems; and, given the newness of what was being tried, a lack of patience on the part of would-be critics.

On the first point, the general misconception appears to be that the only thing they are trying to do at Meade is to prove the feasibility of using ADP at the Class I installation level in the Army—certainly not a job that should take over four years. But in this definition of the task, two terms are left out —integration and service center concept.

Original guidance dated January 1956 states the problem clearly: "In-

The Integrated Computer Run:

What it looks like, what it does . . .



tegrated data processing systems for property, personnel and fiscal accounting at the Class I Installation level which would be compatible with the systems proposed for higher echelons appear to be well within the scope of present technological development. The planned extension of the Command Management System for Class I Installations makes imperative the early consideration of these devices."

To use Automatic Data Processing profitably at the Class I level, integration is a virtual necessity—without it, ADP at this level begins to move towards inaccuracy, high costs of operation, and generally away from efficient operations. The reason is plain. The Class I installation simply doesn't have enough data processing in any one given area to justify automatic data processing. Because of this the service center concept was derived, integrating property, personnel and fiscal accounting.

Thus, integration—doing in one computer run what would otherwise require half a dozen or a dozen. Also, source data is introduced only one time. In a non-integrated system, source data is repeatedly re-entered, providing exactly that much more chance for error. By storing required data from the first entry, this latter problem is eliminated.

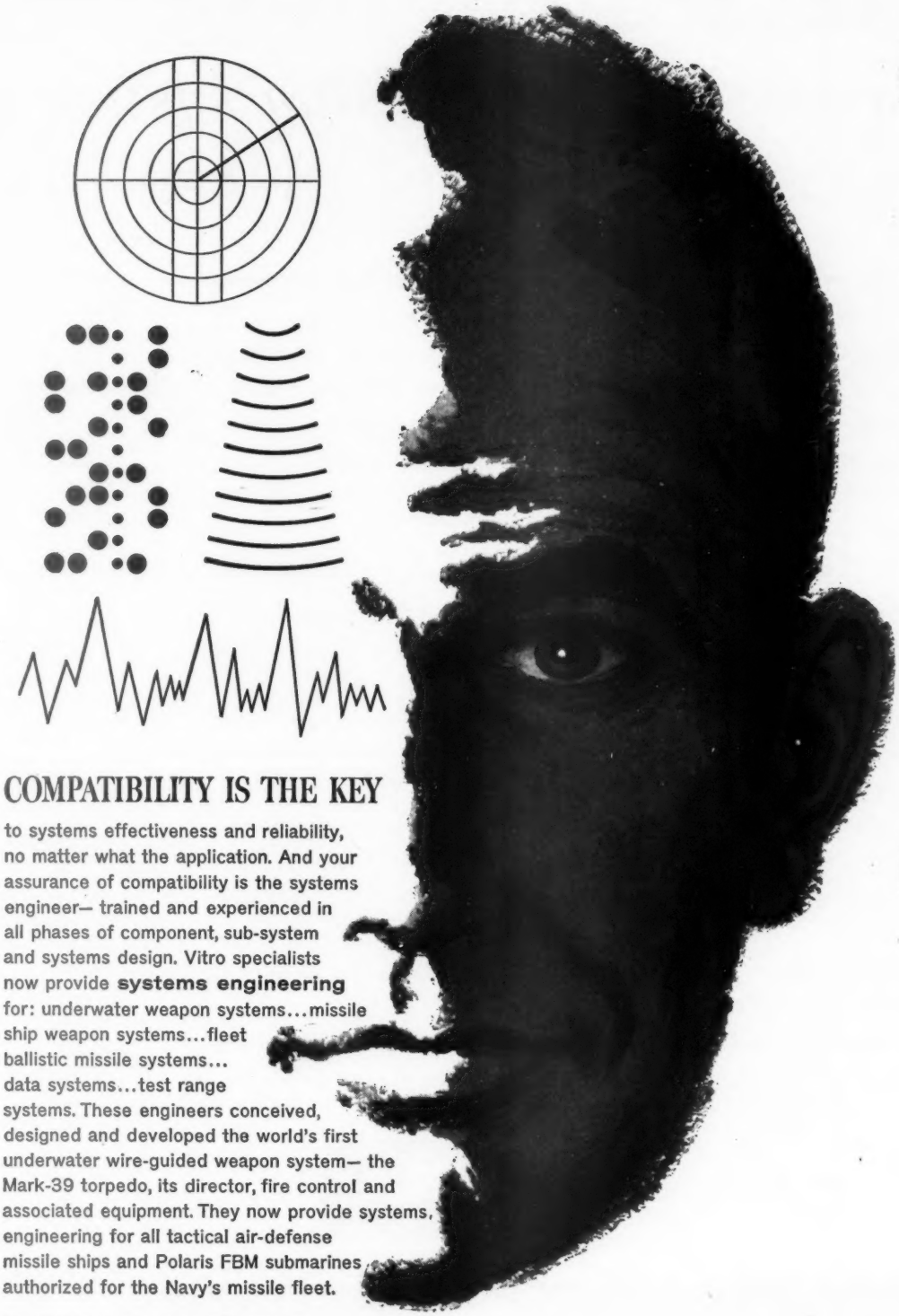
Besides this, the integrated run provides cross-referenced automatic reports for the manager in the area concerned. Instead of needing—for instance—one run on supply levels, one on cost accounting, one on requisition frequencies, and one on total inventory the computer is ideally able to take all of this information, process it as a unit, and come up with the answers in just one run, to be pigeonholed for the several reports.

The Administrative Morass

What is entailed in setting up a program for the foregoing is understandably complex and difficult—and this stems from the basic complexities and problems of the functions being mechanized. To begin with, the people working at Meade found themselves dealing with something on the order of 125 types of source documents stored at some. 63 locations all over the post, which under the former system went into preparing about 155 types of reports—daily, monthly, yearly—of all types.

To quote one program officer, "What we had to do was to purify the existing system—defining in detail the management procedures and requirements needed. To call the job laborious is to understate it. We had to find out what was needed, what management wanted,

(continued on page 33)



COMPATIBILITY IS THE KEY

to systems effectiveness and reliability, no matter what the application. And your assurance of compatibility is the systems engineer— trained and experienced in all phases of component, sub-system and systems design. Vitro specialists now provide **systems engineering** for: underwater weapon systems...missile ship weapon systems...fleet ballistic missile systems... data systems...test range systems. These engineers conceived, designed and developed the world's first underwater wire-guided weapon system— the Mark-39 torpedo, its director, fire control and associated equipment. They now provide systems engineering for all tactical air-defense missile ships and Polaris FBM submarines authorized for the Navy's missile fleet.

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Bendix G-20

the new data processing system with the ORGANIZATION CHART *concept*

"Organization Chart" design in the Bendix G-20 means far faster, more efficient processing of scientific and business problems. The reason is clear:

The electronic manager of every data processing system is a computer. But most are poor "bosses" because they cannot delegate authority, or even supervise more than one operation at a time. Many computers run operations as complex as your own business, but with an inefficiency that you would never tolerate. Bendix engineers saw this shortcoming, and turned for a solution to the organization chart common to any well-managed business.

The G-20 Central Processor, or computer, has a staff of well-taught subordinates that can take instructions from the "boss" and go to work on their own, directing the workers that perform such tasks as reading punched paper tape and cards, looking up data on magnetic tape, and printing results. The "boss" can direct numerous subordinates, and without human intervention, schedule the work for each, making sure the most important work is done first. While the subordinates handle the details, the Central Processor is free to do the all-important computing.

This "organization chart" delegation of authority means several operations may be performed simultaneously, and with a minimum of equipment. The results? Call it "low cost per operation", or "just plain efficiency", but it is all the same . . . the Bendix G-20 gives you more performance per dollar than any other data processing system. The actual performance specifications listed at the right show the tremendous speed and power of the G-20. Components and design are the most modern in the industry today. System sizes can vary from a medium-scale system to a very large system with remote on-line or off-line sub-systems. Write for complete descriptive literature.

SPECIFICATIONS:

MEMORY: Core, to 32,768 words in 4096 word modules.

EXECUTE +: 7 μs. avg., fixed point, one-word precision. 13 μs. avg., floating point, one-word precision.

EXECUTE ×: 49 μs. avg., fixed point, one-word precision. 49 μs. avg., floating point, one-word precision.

ARITHMETIC: Built-in floating pt., 12 dec. digit precision.

CIRCUITRY: Solid-state; parallel; 2.5 kva.

PROGRAMMING: Symbolic assembler or algebraic compiler.

INPUT/OUTPUT: 165,000 char./second max., asynchronous.

MAGNETIC TAPE: 120,000 decimal digit/second read-write.

LINE PRINTERS: 600 lines per minute.

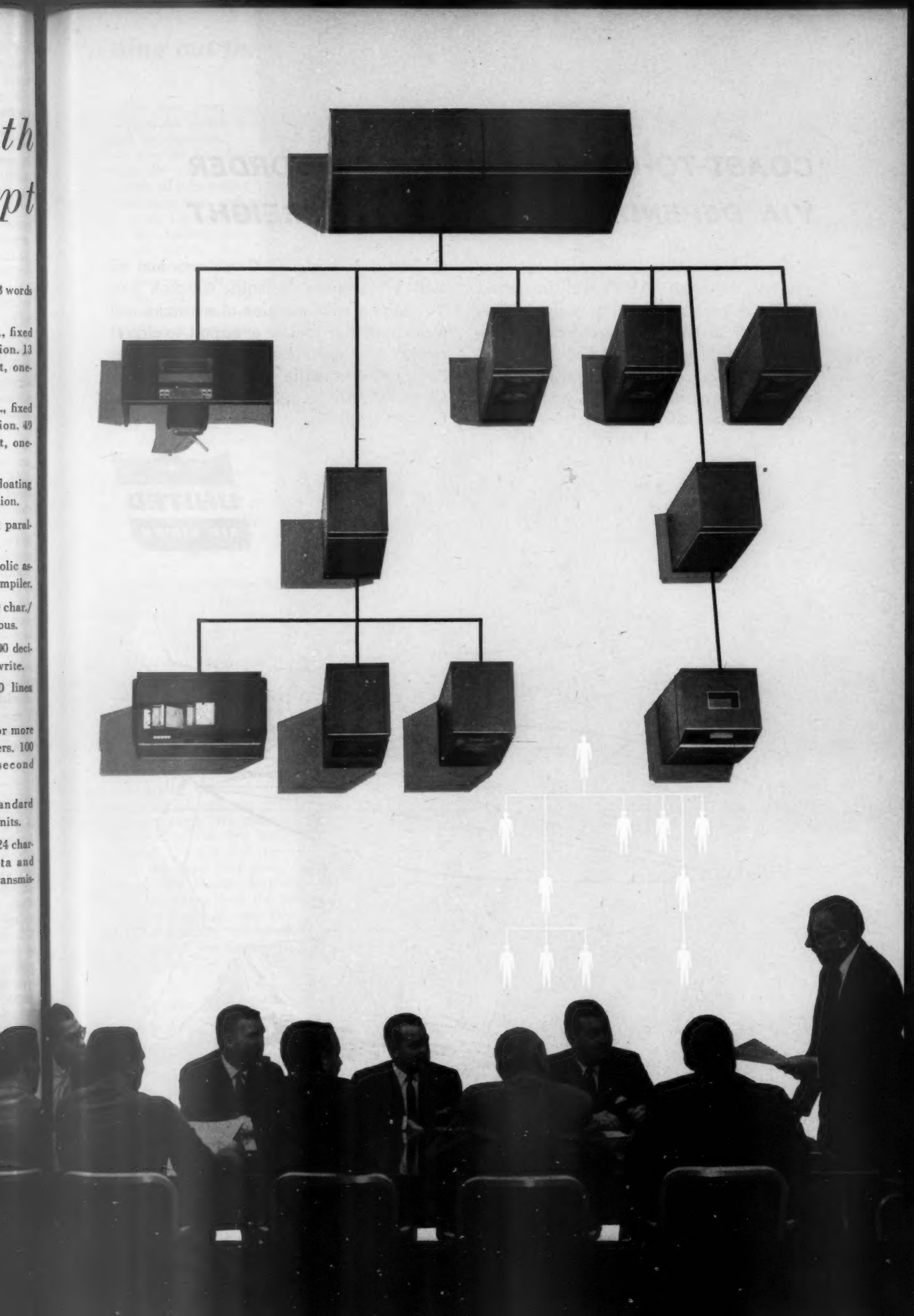
PUNCHED TAPE: 500 or more character/second readers. 100 or more character/second punches.

PUNCHED CARDS: Standard high-speed 80 column units.

CONTROL BUFFERS: 1024 character memory for data and commands. Controls transmission on-line or off-line.

Bendix Computer Division
DEPT. LOS ANGELES 45, CALIF.

THE Bendix CORPORATION



Cutting out the underbrush . . .

(continued from page 28)

and what in the system worked as well as could be expected."

To do this, the Task Force used what was basically an out-sized tic-tac-toe board, with all information inputs listed down the right side, and end products of the given information listed across the top. By checking each input in the appropriate output box, Task Force analysts were provided with several things—accurate control on the collection and coding of documents for analysis, verifiable flow of information and definition of computer problems in terms of input, storage and output. This grid chart, besides other management analysis tools developed by the Task Force eliminated much duplication and overlapping work.

Among the sort of items subject to surgery: reports that had been set up for a specific short-term purpose and had perpetuated themselves; superseded reports that had never been cancelled; and in general all of the excess paper that almost any large organization tends to generate over a period of time. This, of course is no disparagement of Fort Meade—it is a safe bet that any other organization would turn up the same sort of thing if so thorough a management review were undertaken.

Points out one member of the Task Force, "if we had stopped immediately after we finished this part of the study we would have been ahead of the game. What it amounted to was a very thorough management review of the workings at Fort Meade. We turned up mistakes, and we were able to correct them."

Given the above shakedown of the existing system, the Task Force was able to go ahead with the actual computer programing: "We picked supply management as the first area to be mechanized. We felt that the benefits to be gained there were probably the greatest at Fort Meade. At this point, we have just about done the job. The bulk of the technical services are on the machines, and by this October, we will have run off our first quarterly report in this area."

Shaking the Kinks

Originally, five major areas were considered for mechanization: Civilian Personnel Management, Financial management, Supply management, Military Personnel management, and miscellaneous logistics. The latter was a gray area, a hodge-podge of activities, individually insignificant, but combined, well worth computer time. With major work done in supply financial management is next in line.

What this type of programing involves is described by one officer as "like dropping a ping-pong ball into a box-full of mouse traps and ping-pong balls. If you've ever tried it, you know that all hell breaks loose. We hit problems that were far more complex than anyone ever dreamed. Every problem we hit begat a host of new ones, chain-reaction style. And on anything like this, you have to have all of the kinks out."

The most important single thing to remember about the job being done at Fort Meade—and perhaps the one most overlooked by critics—was that in its inception, the program was a research and development type study. The nearest analogy would be the Vanguard space program, never billed as a sure-fire satellite vehicle, but nonetheless damned for not performing like one. The difference here is that the Fort Meade data integration project is well off the ground, while Vanguard is no longer a part of the space program.

What Has Been Done

As a research project, by definition the people were in it to learn—not to slam through an immediately operational piece of hardware. The work at Fort Meade aims to test a system and a concept—not hardware. The problem of setting up integrated computer operations for a base of Fort Meade's size was one that had never been tackled, and one that has still not been tackled anywhere else on a comparable scale. The idea of coming up with just about all of the management data answers in one computer run was new to the Army, and for that matter new to the computer business military and civilian alike.

Says one officer, "We feel pretty good about the amount of progress we've made so far, and yet there is still a lot of work to be done, even in the areas that we've covered. We are probably going to have to redesign forms, redesign procedures, find a better method of input/output work, and change some of our techniques in other areas. I really can't over-emphasize the R&D nature of this thing."

Once the integration project at Meade is finished, the techniques that are set up will apply to any other Class I installation that has a workload volume to warrant installation. "Once we've established the feasibility of the thing at Meade, we will have to do some work to find out whether the whole thing is worth the trouble—as opposed to being something that we can do. We think it is definitely worth setting up at other installations. We do *not* think any and all Class I installations will be adaptable to this.

On the other hand, perhaps thirty or thirty-five of those we have—out of about sixty—should be able to profit by this sort of treatment. Of the others, I would expect a number of them to be satellited to larger installations. Beyond that, on some of the really small ones, we may find out that transceivers, or even regular mail will suffice."

The Price Tag

From a budgetary standpoint, the Meade project to date has cost the Army in the neighborhood of $700,000, over a period of four years, covering the cost of the basic Remington Rand File Computer, as well as the cost of the actual studies. In some respects, this has not been enough.

When the computer was first installed, money problems forced Army to cut a few corners, and, true to Murphy's Law, what could go wrong went wrong. Among the items—air-conditioning problems, down-time because of voltage regulator problems, and perhaps more than the usual share of repair time.

Besides the foregoing, the work at Meade was necessarily carried out in the midst of a military post running full-swing. "It's like testing a new radio for volume in the middle of somebody's living room. Not only do you have loose parts rolling under all the chairs and around the floor, but you're rattling the windows in the building on top of it."

Over-shoulder Watchers

Because of the importance of the work, and because of the proximity to Washington, the people working of the Meade project also probably had more than their share of people looking over their shoulders. But with the rocky beginning for the project, it is only fair to note that the most recent evaluation of the work, completed in May, was by and large favorable to the project—a fair indication from the Defense Department level that the system is beginning to show some promise.

But even more important, from the study has come—and will continue to come—what can well turn into the Bible for similar operations in the Army, and given some allowance for difference in the service requirements, a proven guide for the other-services who want to try to set up the same arrangement for their own installations.

Comparison of Major Computer Syms

Model	Manufacturer	Appli-cations	Numerical System	Input	Memory	Output	Power reqmnt.[1/]	Sq. ft. Area rqmnt.	Cost in $1000 [2/]	Rental per mo.	Reli-abilit
Punched Card Calculators and Computer Systems											
UNIVAC 60	Remington Rand	C-S	BCD	PC-Pat	VT	PC	10	43	75	740-1015	—
UNIVAC 120	Remington Rand	C-S	BCD	PC-Pat	VT	PC	10	43	97.5	1075-1350	—
604	International Business Machines	C-S	BCD	Cr-PC	ET-R	Cr-PC	7.59KVA	19.4	26	550	105T
607	International Business Machines	C-S	BCD	Cr-PC	ET-R	Cr-PC	13.5	36.5	37.5	800	—
609	International Business Machines	C-S	BCD	PC	MC	PC	1KW	12.1	55.5	1175	—
Large Size Computer Systems											
NCR-304	National Cash Register Co.	GP-S-E	Bin.-BCD-Al	PC-MT-PT-K-MchR	MT-MC	MT-PT-PC-K-HiSp	20	1500	850	13,200	.96
G-20	Bendix Corp.	GP-S-DP-DR	Bin. Floating point	PC-PT-MT-An-Ty	MC	PC-PT-MT-HiSp-An-Ty	3.5KVA	154	350	9000	—
PEGASUS 2	Ferranti, Ltd.	E-C-S	Bin.	PT-PC-MT	MD-ADL	PT-PC-MT	50KVA	1000	—	—	.95
LARC-TR	Remington Rand	GP	BCD	PC-MT-K-MD	MC-MD	PC-MT-HiSp	300	2300	5000	125,000	—
UNIVAC I	Remington Rand	GP	BCD	MT-K-Pat-PC	DL	MT-PC-Pat-HiSp	124.5	2500	1279	23,000	.93
UNIVAC II	Remington Rand	GP	BCD	MT-K-Pat-PC	MC	MT-Pat-PC-HiSp	143.9	2500	1521	28,000	.93
1103A	Remington Rand	S-DR	Bin.	Pat-PC-MT-AD	MC-MD	Pat-MT-PC-DA-HiSp	100	1560	1500	30,000	—
M-460	Remington Rand	S-DR	Bin.	Pat-MT-PC-AD	MC-MD	Pat-MT-PC-DA	1.2	27	750	—	—
1105	Remington Rand	GP	Bin.	MT-PC-Pat-AD	MC-MD	MT-Pat-PC-DA-HiSp	170	2000	2172	44,870	—
UNIVAC III	Remington Rand	GP	BCD-Bin.	MT-K-PC	MC	MT-PC-HiSp	80KVA	1440	—	15-30,000	—
Military Real Time Computer	Remington Rand	S-GP-DP	Bin.	Pat-MT-PC-MD-F-K-AD	MC-MD	Pat-MT-PC-F-HiSp-DA	1.2KW	27	—	—	—
MOBIDIC	Sylvania Electric Products	GP-E-S[3/]	Bin.	F-K-PT-PC-Ty-MT	MC-MT	HiSp-Pat-Pr-MT-F[5/]	—	800	—	—	—
704	International Business Machines	E-C-S	Bin.	PC-MT	MC-MD-MT	MT-PC-PR-CRT	96.4KVA	1350	1109	24,450	.98
705	International Business Machines	C	Al-BCD-Bin.	PC-MT	MC-MD-MT	MT-PC-Pr	97	2500	1500	26,000	.95
709	International Business Machines	E-C-S	Bin.	PC-MT	MC-MD-MT	MT-PC-Pr-CRT	130	2000	2484	34,700	.95
7070 (card, tape, RAMAC, RAMAC tape)-Tr	International Business Machines	E-C-S	Dec.	PC-MT	MC-MT-Disc-RAMAC	PC-MT-Pr	35	950	547	12,000	—
7090-Tr	International Business Machines	E-C-S	Bin.	PC-MT	MC-MT	PC-MT-Pr	40	1100	2590	58,300	—
7080	International Business Machines	C	BCD	PC-MT-K	MC-MD-MT	PC-MT-Pr-Ty	30KW	1000	2233	49,000	—
DATAmatic 1000	Minneapolis-Honeywell DATAmatic Div.	C-S	BCD-coded-An	PC-K-PT-MT	MC-MT	PC-Pat-Pr-MT	110	550	985	21,500	.95
GE-150	General Electric Co.	DP	BCD	MchR-MT-Pat-F-Cr	MC-MT	Pr-MT	22KW	2000	800	24,000	.98
501	Radio Corporation of America	E-C-S	BCD-Bin.	MchR-PC-Pat-MT	MC-MT-MD	Pat-Pr-PC-MT	22KVA	1000	616	12,400	.95+
601	Radio Corporation of America	E-C-S	BCD-Al-Bin.-Num	K-Pat-PC-MT-MchR	MC-MT	Pat-Pr-PC-MT	48KVA	1200	1258	28,655	—
2000-Tr	Philco Corp.	GP-DR-E-C-S	Bin.	PC-PT-F-MT	MC-MD	MT-HiSp-PC-PT-F-Pr	24KVA	800	1400	27,500	.99
PERSEUS	Ferranti, Ltd.	C	Bin.	MT-PT	ADL	Pr-PT-MT	3/60KVA	1106	400	—	—
ATLAS	Ferranti, Ltd.	E-S	Bin.	PT-PC-MT	MT-MD-MC-MS	PT-MT-PC-Pr	8KW	2000	—	—	—
ORION	Ferranti, Ltd.	E-C-S	BCD	PC-PT-MT	MT-MD-MC	PT-PC-MT-Pr	1.5KW	1200	—	—	—
SIRIUS	Ferranti, Ltd.	E-C-S	BCD	PT-PC	ADL	PT-PC	8KW	100	—	—	—
1604	Control Data Corp.	C-E-GP-GS-S-DR	Bin.	PC-MT-PT-Pat	MC-MT	MT-PC-PT-Pat	5KVA	400	900	25,000	.99
Medium Size Computer Systems											
UFC-0	Remington Rand	C	BCD	MT-K-PC-Pat-Special	MD	MT-PC-Pat-HiSp-special	12	1000	300	7000	—
UFC-1	Remington Rand	C	BCD	MT-PC-K-Pat-Special	MC-MD	MT-PC-Pat-HiSp-special	20	1000	500	12,500	—
USS 90	Remington Rand	GP	BCD	PC-MT	MD	PC-MT-HiSp	14.4	530	347.5	6950	—
USS 80	Remington Rand	GP	BCD	PC-MT	MD	PC-MT-HiSp	14.4	530	347.5	6950	—
M-64	Sylvania Electric Products	GP-E-S	Bin.	Pat-MT	MC	Pat-HiSp-MT-RT	3KVA	20	—	—	—
650 (card)	International Business Machines	E-C-S	Dec.	PC-PT	MD	PC-Pr	17.7KVA	250	182	3750	.95
650 (tape)	International Business Machines	E-C-S	Dec.	PC-MT-PT	MD-MC-MT	PC-MT-Pr	50	1000-1200	356	7500	.90
RAMAC 650	International Business Machines	DP	Dec.	PC-PT	MD-MC-Disc	PC-Pr	50	1000-1200	374	7300	.90
RAMAC 650 (tape)	International Business Machines	E-C-S	Dec.	PC-PT-MT	MC-MT-MD-RAMAC (Disc)	PC-MT-Pr	60	1800	432	8750	.90
RAMAC 305	International Business Machines	DP	BCD-Al	PC-PT	MC-MD-Disc	PC-Pr-Ty	16	400	190	3250	.90
1401	International Business Machines	C	BCD	PC-MT	MC-MT	PC-MT-Pr	7-17KVA	336-448	125.6	2475	—
Honeywell 800	Minneapolis-Honeywell DATAmatic Div.	E-C-S	BCD-Bin-coded AN	MT-CR-Pat-K	MC-MD-MT	Ty-HiSp-Pr-PC-Pat-MT	25KVA	850	550	11,000-18,500	—
Honeywell 400	Minneapolis-Honeywell DATAmatic Div.	C	BCD-coded AN	PT-PC-MT-MchR	MC-MT	HiSp-Pat-PC-MT	25-30KVA	600-825	390	8660	—
GE-210	General Electric Co.	DP	BCD	MchR-MT-Pat-F-Cr	MC-MD-MT	Pr-MT	12KW	1200	400	12,000	.98
301	Radio Corporation of America	E-C-S	BCD	Pat-PC-MT-MchR	MT-MC-Disc	Pat-Pr-PC-MT	8KVA	350	103	2040	—
Basicpac-Tr	Philco-Corp.-Computer Div.	GP	Bin.	PT-MT-K-RT	MC	PT-MT-K-RT	2.1KVA	8	—	—	—
MARK I	Ferranti, Ltd.	S	Bin.	PT	MD-CRT	Pr-PT	26KW	600	400	—	.97
MERCURY	Ferranti, Ltd.	S	Bin.	PT-MT	MC-MD	PT-Pr-MT	40KVA	36	400	—	—
PEGASUS	Ferranti, Ltd.	S	Bin.	PT-MT	MD-ADL	PT-Pr-MT	12KW	60	200	—	.98
RPC-4000	Royal McBee Corporation	GP	Bin.	PT-PC-Ty-K	MD	PT-PC-Ty-HiSp	.72KVA	100	87.5	1750	—
RPC-9000	Royal McBee Corporation	GP	BCD	PT-PC-Ty-MT	MT-ADL	PT-PC-Ty-HiSp-MT	.2KVA	150	120	2450	—
LIBRATROL 500	Librascope Div., General Precision, Inc.	C-E-S-GP	Bin.	Ag Ty-K-Pat-switch	MD	Ag Ty-PT relays-MT	2KW	16.	85	—	.98

Model	Manufacturer	Applications	Numerical System	Input	Memory	Output	Power reqmnt.1/	Sq. ft. Area rqmnt.	Cost in $1000 2/	Rental per mo.	Reliability
LIBRATROL 1000	Librascope Div., General Precision, Inc.	C-E-S-GP	Bin.	Ag Ty-K-Pat switch	MD	Ag Ty-PT relays	1KW	16	120	—	—
PB-250	Packard Bell Computer Corp.	GP-S-E-DR-DP	Bin.	PT-MT-PC-F	MDL	PT-MT-PC-F-HiSp	100	3.2	30	—	.96
TRICE	Packard Bell Computer Corp.	S	Bin.	PT-K-AD	DL	Readout Register-PT-D-A-XY plot	480	12	100	—	.97
MONROBOT VI	Monroe Calculating Machine Co.	S	BCD	K-Pat	MD	Pr-Pat	17KW	40	95	—	.98
G-15	Bendix Corp.	GP-S-DP-DR	Bin.	PC-PT-MT-K	MD	PC-PT-MT-Ty-plotter	3.8KVA	60	49.5	1485	.98
ALWAC-III E	Alwac Computer Div., El-Tronics, Inc.	GP	Bin.	PC-PT-MT-F	MD	PC-PT-MT-F	8KW	28	77	2585	.97
205	Burroughs Corp.	GP	BCD	PC-PT-K-MT	MD-MT	Ty-PT-MT-PC	21KVA	400	135	3900	.97
220	Burroughs Corp.	GP	BCD	PC-PT-K-MT	MC-MT	Ty-PT-MT-PC-HiSp	30KW	540	320	7800	.98
RW-400	Thompson Ramo Wooldridge, Inc.	C-E-S-DR-DP	Bin.	Cr-E-MT-PT-K-DC	MT-MC-MD	F-MT-HiSp-PR-PT-Ty	30	200	—	—	.99+
160	Control Data Corp.	C-E-GP-GS-E-DR	Bin.	MT-PC-PT-Pat	MC-MT	MT-PC-PT-Pat	700	Desk	60	1500	.99
Small Size Computer Systems											
1620	International Business Machines	S	BCD	Pat-Ty	MC	Pat-Ty	2KW	21.8	74.5	1600	—
C-3000-Tr	Philco Corp.-Computer Div.	GP-C-S-E	Serial Bin.	PT-F-K-Shift Regs.	MD	PT-F	.5KVA	4.5	—	—	563MF
Compac-Tr	Philco Corp.-Computer Div.	GP	Bin.	PT-MT-K-RT	MC	PT-MT-RT	2.1KVA	4	—	—	—
LGP-30	Royal McBee Corporation	GP	Bin.	K-PT-PC	MD	F-PT-PC-Ty	115	50	43.5	1100	.95
Monrobot XI	Monroe Calculating Machine Co.	GP	Bin.	TT28-PC-Ty-Pat-K	MD	Ty-PC-Pat-TT28	9KW-Tr	16	24.5	—	.95
Distributape (Monrobot X)	Monroe Calculating Machine Co.	DR	Bin.	Pat	MD	Pat.	2KW	20	35	—	.90
Monrobot IX	Monroe Calculating Machine Co.	C	Bin.	Ty	MD	Ty-PC	.6KW	desk	9.6	—	.95
B-101	Burroughs Corp.	C-S	pulse coded dec.	K-PC-PT	PT-MD	Pr-PT	3KW	desk	25.5	1000	.96
NCR-390	National Cash Register Co.	GP	BCD	PC-PT-K-magnetic ledger	MC	PC-PT-Pr-magnetic ledger	3KVA	40	75	1850	.97
FADAC6/	Autonetics Div., North American Aviation	GP-GS-E	Bin.	Pat-MT-K-FADAC	Disc.	PT-Ty-MT-NT-FADAC	Tr	5.3	—	—	—
RECOMP II	Autonetics Div., North American Aviation	GP-S-E	Bin.	Pat-K-Ty	Disc.	PT-Ty-NT	Tr	2.7	95	3000	—
VERDAN	Autonetics Div., North American Aviation	GP-GS-S-E	Bin.	K-PT-MT-pulse, shaft	Disc.	PT-MT-display-Ty-voltage, shaft, Bin.	Tr	1.4 cu. ft.	—	—	—
RW-300	Thompson Ramo Wooldridge, Inc.	C-E-DP-DR-GD	Bin.	F-MT-PT-K	MD-MT	F-MT-PR-PT-Ty-CRT	.6	desk	98	—	.99+
Special Purpose, Experimental, etc. 10/											
CG-24	Mass. Inst. of Technology	GP-RT radar data	Bin.	radar data F-MT-photo reader	MC-toggle switches	F-CRT-MT-antenna positioning servo	5KW	100	—	—	—
MANIAC II	University of California	physical research	Bin.	PT-MT-K	MC-MT-CRT	Pr-PT-MT-Ty-CRT	30KW	150	350	—	—
ATC-(air traffic data control processor)	Librascope Div., General Precision, Inc.	GP-mil surveill	An	Pat-TT-28-Ty	MD	Ty-F display	90 (For entire 4 comp. sys)	160 (entire system)	—	—	—
RASTAD	Laboratory for Electronics	aux. storage & display	dec.	MT-Pat-K computer output	MD	CRT-MT-Pat Pr	32	275	300	—	100MF
RASTAC	Laboratory for Electronics	aux. storage	dec.	MT-Pat-K computer output	MD	MT-Pat-Pr	10-30KW	250	175	—	100MF
AD-1	Applied Dynamics, Inc.	GS-E	Ag	Function Generator	—	CRT-XY-Plot Strip	.6KW	desk	2-20	—	.98
GE-312	General Electric Co.	E-S	Bin.	F-Pat-Ag-Sca	MD	F-PT	4KW	18	80	—	—
Leprechaun	Western Electric	computer research	Bin.	PC	CRT-MD	PC	20KW	22	500	—	.70
UDOFT	Sylvania Electric Products	SP-RT	Bin.	PC-K-CR-AD	MC	Ty-DA	28KVA	1200	—	—	—
ATHENA	Remington Rand	DR	Bin.	PAT-F	MC-MD	Pat-MT-F	800W	250	—	—	.998
TIC	Remington Rand	DR-GP	Bin.	F-MT	MC-MW	F-MT	2.5KVA	35	—	—	600MF

NOTES: Because of confusion surrounding access times and speeds, which are not standardized, they are omitted.
1/Power requirement and area requirements are for the basic computer only—do not include air conditioning and the like.
2/Cost and rental figures are for basic computer system only and are approximate.
3/Includes refrigeration.
4/Computers listed here are only a representative sampling of the several score machines which have been built, primarily in quantities of one or two, mainly by universities or the services themselves to serve a special purpose.
5/Up to 63 input-output devices including disc memory and teletype terminals.
6/FADAC outputs to and accepts input from another FADAC directly.

KEY:

AD—on-line analog to digital converters
ADL—acoustical delay line
An—Analog
Al—alphabetical
An—alphanumeric
BCD—binary coded decimals
Bin—binary
C—commercial
Cr—card reader
CRT—cathode ray tube
DA—on-line digital to analog converters
Dec—decimal
DL—delay line
DP—data processing
DR—data reduction
E—engineering
ET—electron tube
F—flexowriter
GP—general purpose
GS—general scientific
HiSp—high speed printer
K—keyboard
MC—magnetic core
MchR—magnetic character reader
MD—magnetic drum
MDL—magnostrictive delay line
MF—hours meantime between failure
MS—magnetic slug store
MT—magnetic tape
MW—magnetic wire
NT—nixie tube
Pat—paper tape
PC—punched cards
Pr—printer
PT—punched tape
RT—real time
S—scientific
Sca—raw data scanner
SD—sonic delay line
SP—special purpose
ST—avg. service time per mo.
Tr—transistor
TT28—Teletype Model 28
Ty—electric typewriter
VT—vacuum tubes

Air Force, Evolution and ADP

by Lt. Col. Hugo Zimmermann, USAF

In many ways, Automatic Data Processing has offered a more significant set of changes on the military business scene than intercontinental missiles. This is how one service is meeting the challenge that ADP has posed . . .

SOME PHILOSOPHER once said that "Facts, like fish, are better fresh." Fresh facts, not history, are particularly urgent in the military where managers constantly strive to keep pace with, among other things, new weapon systems development.

Sophisticated weapons now in Air Force inventory, for example, make fine testimonials to successful development program efforts. But unless they can be delivered effectively, their deterrent value is reduced and they add little to our over-all defense posture. To help fill that gap, to assure that accurate, timely data goes to decision makers at all echelons, Air Force has turned to automatic data processing.

In the past 10 years ADP has been used in more and more areas and in increasing quantities in the Air Force. Dependence on and use of ADP must continue to grow if urgent needs for greater quantity and quality of management, scientific, and operational data are to be met. Air Force is committed. To pull back would mean a huge sacrifice in management capability.

Prior to 1939, no centralized control of data gathering and processing existed in the Air Corps. Not even reporting methods were standard, and only a limited idea of statistics was generally accepted. Many offices kept their own records with no regard to the Air Corps as a whole.

Spotting the almost obvious void, Air Corps studied ways to coordinate and simplify statistical data. From this study, a centralized reporting agency emerged, with a machine accounting unit as an integral part.

The present data collection and processing organization followed an even greater evolution in development and use of automatic data processing equipment. It was clear early that this was an answer to the ever-increasing need for timely and accurate data.

From about 1953 on, technology advanced so fast that at times the Air Force found itself saddled with procedures for Model "T" equipment with Cadillacs available for the job. Air Force needed potentially faster, more flexible equipment. (It has never been possible to fully satisfy the desire for fresh facts.)

To get management "fresh facts—not history," ADP stretched down to the base level. By 1955, the USAF Base Mechanization Program was cranked up. Granted that the most fruitful results from this would come from standard Air Force-wide procedures, only a limited capability existed for their development without ADP. To capitalize on potential ADP benefits as early as possible, and because of a dollar shortage, each command was told to develop its own program.

By mid-1955, 74 Air Force bases were using punch card processing. Today, 157 bases are in the business—most installations with volume to warrant ADP methods.

Faster, Cheaper Facts

The 1955 results? More complete, accurate, and timely data were being given to management at less cost. While supply work proved most lucrative, machines were more economical than manual methods in most other areas. Among these: Supply, Maintenance, Personnel, Financial Management, and Medical.

About the time base mechanization moved into high gear, there was a new rumble: Electronic data processing equipment, with all its glamour and fanfare. This revolutionary approach to automation was felt throughout the spectrum of data processing in both government and industry.

The EDP phase of Air Force automatic data processing actually started in June 1952 when a computer was installed at USAF Headquarters for war plans computations and program document mechanization. A second computer was set up at Air Materiel Command headquarters in 1954 for logistic work. From this meager beginning, EDP mushroomed. By fiscal 1957, systems in use totaled to 25, jumped to 73 by 1959, has now reached a total of 151.

Where is all this equipment and how is it used? About 46% (based on dollar cost) is within AMC—understandable considering the scope of AMC's support mission and its adaptability to mass data processing. The rest of this equipment is scattered through other Air Force commands.

Growing Pains and Cost

Growing pains, plus expenses made central management of the Air Force ADPS a must almost from the start. This management, exercised through procurement and budgetary control, has been effective enough to make total results more than commensurate with costs.

The keystone for all this has been Air Force Manual 171-9, "Management of Data Processing Equipment." It spells out in detail over-all policies and procedures with respect to advanced planning, purchase, installation and operation of data processing equipment.

But this covers only part of the management responsibility. We still need farsighted, aggressive action by all managers in areas such as organization, motivation, and control of human effort. Automation is a critical area where management must *manage*, if full benefits are to be realized.

Looking ahead, it appears that the biggest payoff, in both efficiency and economy, lies in more sophisticated base level automatic data processing.

Enough essential data processing exists at most bases to warrant the change from conventional equipment. With such change, truly integrated data processing can become a reality. But to achieve this, the system must meet the following criteria:

Responsiveness must be commensurate with operating needs of the agencies supported.

Economy must be assured unless mission operational needs are sufficient to override it.

Flexibility must be inherent in the system to permit further development to keep pace with operating conditions.

Reliability must be such that using agencies are assured of accurate, timely data for mission accomplishment.

Security of system must be consistent with classification of data to be processed.

Data automation at the source level will require a whole "new look" at information needs without traditional organizations and functions. Systems development must be geared to total missions rather than to merely gathering and reporting statistics.

And in front of all this activity, the ultimate objective remains the same—to provide management with time-compressed "fresh facts" for decisions.

Source Data Writing:
THE COMPUTER BOTTLENECK

It has been a source of some consternation to military installations endowed with large scale, expensive computers that the cost savings they first predicted have not jelled. One big reason: cost of converting basic records to a form the computer can handle, often as high-priced as the system itself. Part of the headache: preparing source data. Mechanization the answer . . .

MILITARY installations, and private industry as well, are becoming more and more aware that the large, expensive computer, glamorous and efficient as it is, is not the total answer to their problem of handling mountains of information more rapidly and effectively.

Owning one of these units is, in fact, a good deal like owning a Cadillac without an engine. The computer itself is only part of the system and needs quantum technological jumps in supporting equipment to be fully effective. One reason the computer has not lived up to all its glamorous promise is that the tremendous volumes of variable data it handles must first be converted into the computer's language—a process often as costly as the system itself.

Conversion is still largely a manual operation. Each piece of data fed into the computer must first be pounded out, character by character, primarily onto, first, cards, and then tape.

Thus, almost by definition, the key punch operator has become a bottleneck in a system whose goal and primary design is as much automation as possible.

And because key punch operators are only human, not only is the comparative speed not all that is desired but there are a good many errors in the transition.

Human Frailty

Example: at the Norfolk Naval Shipyard, there are 29 supply centers. Thousands of employees pump requisitions through these centers each year. Because of this human frality in conversion, there are as many people correcting errors in requisitions as there are writing them.

Here, as in many other supply installations, the number of errors caught has sometimes run as high as 25 to 30% of the chances for making an error. The nagging headache in the back of the computer operator's mind: "How many don't we catch?"

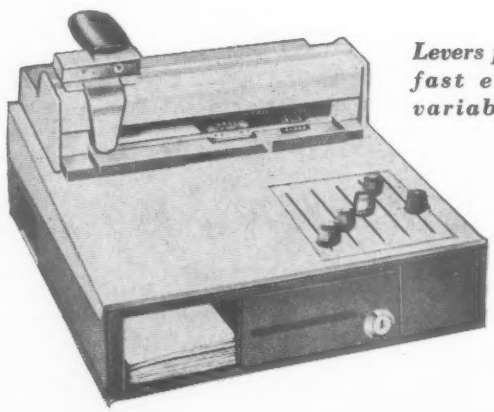
Without going into details, the chance of errors being pushed into the computer without being caught has been called "good" by the boss of the operation at one Army installation. Said an Air Force major, "and the computer doesn't think. If you put garbage in, you'll get garbage out."

The answer, of course, must ultimately lie in eliminating the key punch operator or cutting down her contribution as much as possible. The work done recently in automatic computer input of data, primarily via some character sensing method, has generated a great deal of excitement in the business, promises a possible major breakthrough for the computer towards living up to what is expected of it.

Greatest chance of early success for an automated data supply system is in logistics. One reason: the number of standard repeat orders which are now requisitioned manually either by writ-

Few steps, few chances for error

Upon return to window, storekeeper places plastic card into variable data recorder



Levers permit fast entry of variable data.

Storekeeper sets levers for . . .
• Job order number
• Quantity
and places original requisition form into data recorder

ing or typing out the order. All these could be handled by providing a card, much like an oil company credit card, to the men who place the requisitions.

Once the card is right, it would never have to be changed, could pour information direct from the supply center to the computer without a hitch. Example: Dayton Air Force Depot, prime on over 300,000 items for Air Force Supply, estimates at least 25% of the items of the orders it fills are periodic, standard repeats.

Industry Effort

A number of firms are either working on or producing hardware which will perform this character or document scanning function, in effect actually reads as a human eye the contents of a requisition, purchase order, etc. The goal of all of them, basically, is to move from original document immediately into the computer without human intervention.

One example of many: the Addressograph-Multigraph Corporation's system for mechanized preparation of supply issue cards providing, as a by-product of writing, an automatic input document compatible with an existing electronic data processing program.

The objectives: mechanized writing of issue cards with 100% accuracy, complete item information, and typewriter legibility; mechanized punching of issue cards for EDP equipment with 100% accuracy, no key punching or verifying; reducing operating costs by key punching requirements, proofing of erroneous stock numbers, and by speeding issue document preparation. (One additional advantage, A-M claims, is that no specially skilled personnel are required.)

The A-M system centers around a bar code scanning setup, is applicable to other procedure such as repair tool requisition. One good illustration would be its use in the shop store division of the supply department at Norfolk Naval Shipyard which like many similar military setups must fill material requirements for shipbuilding, ship repair, and yard maintenance user activities. Twenty-nine shop store outlets handle approximately 65,000 line items, issue some 60,000 line items a month. Records of issue are made manually, in longhand mostly, on a form DD-1150.

The shop bosses or other authorized persons fill out the form with job order number, date, requesting shop, chargeable activity, item description and quantity and hand it to a shop employee who goes to the proper shop store, hands it to a shop storeman.

Storeman takes the form with him to wherever the item is located, enters the stock number and unit of issue on the form from the bin label, enters the request number and checks to see if the form is properly filled out. After all this paper work, the shop employee receives the item, signs the form.

Periodically the forms are forwarded to data processing. The problems in accuracy and rapidity of transactions are obvious: are all those numbers (job, stock, unit of issue, etc.) and all other data marked on the form accurate? All paperwork operations are done manually and stock numbers are slow and difficult to copy.

At a data processing section, for preparation of shop store transaction cards, hand written data is translated into machine language by manual key punching which requires both punching and verification. Net result is that the key punching is only as good as the source data, transposition errors are easily made, and Norfolk needs two full time employees to handle key punching and verifying—plus two more employees to search for erroneous stock numbers.

DD-1150 is the only document in Norfolk which can provide the computer with data as to what material is issued, who uses the material, and in what quantities, and who pays for it—and DD-1150 is only as accurate as the data entered.

Thus, under the manual operation only the computer output can turn up the inaccuracies and these inaccuracies cause emergency procurement, re-submission of corrected issue cards, loss lead time, charges made to incorrect or non-existent job orders and a disagreement between physical and paper inventories. One of the key reasons for this continual last minute headache is that the key punch operation for providing modern computer input is slow, inaccurate and costly.

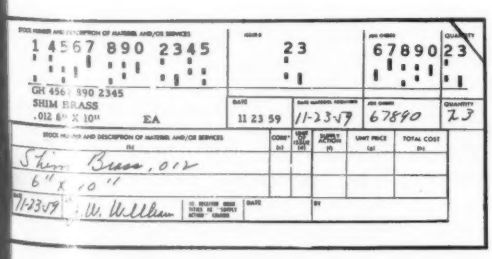
Effective Simplicity

Under the automated system, a plastic card is embossed with the stock number, nomenclature and unit of issue for each item in the store. The card is located with the item in the store room. (Plastic cards can also be embossed for each job order number current in the yard and carry, as well, the shop store number.) Cards are filed in a rotary card holder or visible index file for fast location and removal, issued to all stores.

Upon receiving a prepared DD-1150 or other request form, the storeman would get the item and then pull the corresponding card. The storeman would pull the proper job card from the visible file, place both plates in an imprinter and lever set the quantity issued and the using shop. Placing a blank issue form in the imprinter, he can, in one stroke, write the stock number, job number, quantity and using shop.

Periodically, imprinter cards are forwarded to the electronic data processing center where cards are processed through a scanning punch which optically scans the bar codes and punches a stock number, job order number, issuing store, quantity and receiving shop in one operation at the speed of some 180 cards per minute. The result: an input document completely machine-prepared with accuracy verified.

This is only a highlight examination of just one small segment of one shop. But it is an indication of the work being done by several companies to solve one of the key headaches to most effective use of data processing equipment —a mechanized, verified accurate automation of source data input.



In one quick stroke of the platen, the . . .
- ***Stock number***
- ***Item description***
- ***Unit of issue***
- ***Issuing store***
- ***Job order number***
- ***Quantity***

are all written to the requisition form in both human and machine sensible language

Pentagon Profile

This Month:

Charles A. Phillips

Director, Data Systems Research Staff

EARLY this year, in a talk to the Industrial College of the Armed Forces, Charles A. Phillips, Director of the Data Systems Research Staff, said, "I don't know much about theology so my analogy may be wrong in the assumption that you must sin before you are in need of salvation. If sin is necessary, we have certainly committed about all the sins there are in anybody's book on good management practices. From experience, we are also finding out what we should do to achieve 'salvation.'"

Speaking from a background of ground-floor-up experience in the computer business, Phillips was discussing one of the Pentagon's most serious ADP headaches: "to too many people, in the past, and even today, installing hardware is our purpose. This is just not true. The computer is a tool. It is only as good as and should be used only where it is profitable or advantageous to the people using it."

The Biggest Buyer

In the largest business in the world, Phillips is what amounts to the top management ADP "project officer." Not only biggest buyer in the business, Defense has also generated some of the most far-sighted proposals for ADP improvement, is leading the mechanical brain revolution in a nation which, in turn, is far ahead of the world in the use of electronic data processing machinery to do its business management job.

One of the most knowledgeable men in the field, if for no other reason, because he has been in it since the now-waning punch card days, Charlie Phillips and his ideas are listened to with a great deal of respect, not only within Defense itself but throughout the industry. Among his more recent comments:

"Most serious recurring headache we face, I think, is what I call a preoccupation with hardware or a 'get on the bandwagon' type of approach. In such cases, there is often a complete failure to make a system study. The result is simply a substitution of a computer for the previous punch card equipment —with little or no change in the basic system. You can't just stop improving the system and programming when you install the hardware—or this business will never get anywhere."

This bandwagon attitude also earns his office an occasional black mark since he is frequently the first in a long succession of reviews to throw an unemotional, unpolitical, cold, hard stare of facts at some CO's computer request.

Born 54 years ago near Hastings, Nebraska, Charles Augustus Phillips went to Hastings College one year, left to go into the insurance business, left that in 1934 to be a Lincoln, Nebraska, accountant-in-charge in the U.S. Treasury Department office handling the punch card records of area relief fund disbursements. After a four year stint in the Army, (from 1942 to 1946, when he ran the largest punch card operation, at that time—in the states) he went to work for the State Department as Assistant Director of Finance.

Two years later he became one of what Pentagon natives call the "founding fathers," took a job as Assistant Director of Accounting Policy in the brand new Defense Department's Comptroller Office in 1948.

When the requirement for data systems analysis was placed on defense in 1954, Phillips was picked to handle it, has seen the primary task (review and approval of EDP equipment requests) grow from a one-man job "when you have all your other work done" to a separate data systems division.

Once a separate office within Defense reporting directly to the Comptroller, a reorganization at the Secretary-of-Defense level in late 1959, placed it under the Deputy Defense Comptroller. But, in effect, Phillips still formulates the policy on where EDP is headed in the military. A soft-spoken, relaxed leader in the field, Phillips' absorption with the business shows up in his office decorations.

In contrast to the missile and aircraft models generously distributed elsewhere in the Pentagon, Phillips' idea of interior decoration includes photographs and highly polished bits and pieces of hardware out of computer laboratories. (Only exceptions: a four-color aerial photograph of an aircraft carrier on which he took active duty as an Air Reserve colonel, an autographed picture from former Defense Comptroller McNeil.

One gauge on EDP's explosive growing pains in Defense: Phillips and his small office used to handle individual requests for machinery on an individual basis, are now trying to move into a "programs" approach, leave specific installations of specific hardware to the military departments themselves. One goal: push the military departments into a more comprehensive EDP-use planning effort, draw the managing of programs up to a higher level where coordination and control are stronger. Services have had spotty records on both counts.

Drag on Progress

There has been progress but there is still a long way to go. Part of the drag is due to the bandwagon attitude noted before, part of it due to sheer defense inexperience in the business, part of it to a less than total understanding that the hardware is a tool and not an answer by itself to military management problems.

But there has been success, too. Latest advance: COBOL (for COmmon Business Oriented Language), a computer language which uses English words, not numbers and letter codes to command a machine. As Chairman of the Executive Committee which helped develop and approve COBOL, Phillips has high praise if not for COBOL's present stature, at least for its potential.

"We don't have a panacea, but the means to correct the problems are in the hands of the people who are critical of COBOL's weaknesses.

"First step in COBOL has been to build a language which all programmers, regardless of their specific manufacturer-hardware education, could use." Next step: refine COBOL, concurrently develop a common language for systems analysts (some of whom may be surprised to learn they don't all speak "the same tongue") and at some point in the future, come up with a language which even managers can understand. The idea: to break down today's technical barrier between the manager requesting information and the machine providing it.

"One of our big problems in effectively utilizing the computer is that only a very, very few decision-makers have enough computer background to feel assured that the information being provided by the mechanical brains is really the answer that the manager requested of it." COBOL, he hopes, will be a first and very large step in this direction.

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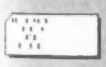

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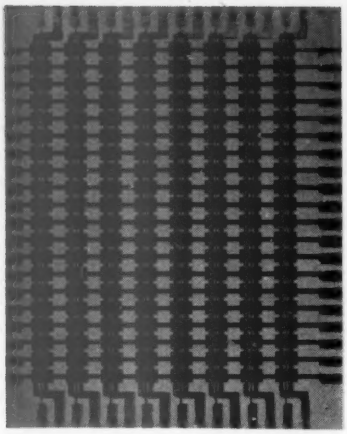


Computer Technology: Where is it Headed?

by Robert A. Tracy
Manager, Applied Sciences Department
Burroughs Corporation—Research Center

PREDICTING future developments in the computer business calls for a seer with a microscope to find minute details of the thread of current research and study efforts, plus a loom to weave these bits and pieces into a unified pattern. But even this will not be accurate unless consumer requirements are incorporated, adding emphasis to specific parts of the pattern.

Instead of predicting complete machines of the future, some of the technical aspects of computer research bear study. My predictions are based on success in the individual areas and on the bearing component success may have on future machines.

Research in basic sciences will continue to receive a great deal of attention from the computer business, for applying fundamental studies provides the basis for continuing advances. Future advances in the scientific area that will make a significant impression on the computer business in the next ten years can be based only on presently known research and development areas. Technical breakthroughs will certainly occur, but these are so unpredictable that they cannot be discussed in detail.

Cryogenics and Speed

Cryogenics is relatively new; therefore, significant advances are likely. These advances will generally lead to smaller computers, lower manufacturing costs, and reduced debugging time. Speed range appears to be limited to the 10^6 to 10^7 cycles-per-second region with superconductors. Semiconductors at low temperatures can possibly hit in the 10^{10} cps region. This field seems to exclude computer input-output areas. Cooling requirements detract heavily. Automatic fabrication is quite likely.

Breakthroughs, beyond present work, in semiconductors will most likely be in solid circuits and the multifunction components. Advances could yield a probability action component, a high density static memory, or greatly reduced fabrication cost.

New processes for forming magnetic materials "in place" and for sensing magnetic states could advance the art significantly, especially in costs. Also, very high frequency devices will appear.

It is doubtful that a real impact will be made by microwaves in data processing until the centimeter wave length is more practical.

Within ten years, rather large advances can be expected from chemistry. Semiconductive polymers have already been announced. Color chemical phenomena are under intensive study, as are electrochemical phenomena. This work could materially affect the memory, logic, and output technology in the computer field.

Electro-optical work has been pushed, without notable success, for several years. Visual indicators for rapid trouble-shooting will come out, as well as display devices but nothing radical is expected.

In Materials Research putting specified materials in predetermined locations by automatic means will reduce fabrication costs. Vacuum deposition, sputtering, vapor deposition, and electrodeposition are receiving much attention. Materials under investigation include magnetic metals, ferrites, insulators, semiconductors, dielectrics, and conductors.

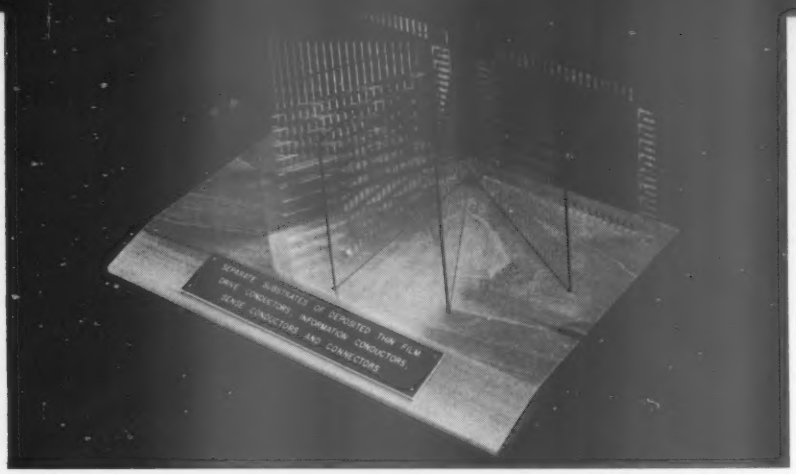
A fast look at current literature shows an extensive effort in mathematics and switching theory, with a view toward the complete synthesis of computers. The initial work is on logical design mechanization. Algorithms for determining minimum or optimal forms, topological methods for the synthesis of Boolean networks, mathematical theory of switching circuits, and many other efforts are included. The ultimate in this area will be an analytical expression for Boolean functions.

Component Impact

Statistical or probability concepts will become more important if some way of building such machines could be devised. Semiconductive polymers or electrochemical phenomena are good candidates for realizing these powerful concepts.

Impact of a new component or technique on a total system will be small. For instance, reducing memory cost by 50% would not greatly alter the selling price. Or, an increase in speed of a given section would not alter overall performance, providing that the specific item was not a bottleneck. However, the *sum* of new techniques will definitely affect the performance per dollar.

Several approaches to improved



SEPARATION of magnetic film shown on facing page shows the following "pages" from left to right: 1) *end tabs for conductors*, 2) *twenty drive conductors*, 3) *eight information and sense conductors*, 4) *160 bits thin film elements*, 5) *eight information and sense conductors*, 6) *twenty wire drives, and* 7) *end conductors*. Insulators can be represented by glass leaves, as shown.

memory systems, just now in the research stage, will bear fruit within the next few years:

Twistors. The twistor can provide a one-to-one replacement of ferrite core memory in operational behavior now, with a future higher speed. The cost is low because of less testing required, no through-hole wiring. Temperature limitations and driver specifications can be relaxed. Their present use is limited to non-destructive memories, but linear-select memories will soon be available. Their incorporation into commercial machines should start in 1961, with prototypes being completed the same year. A 30% to 50% reduction in memory *stack* cost should be realized.

Thin Films. At a somewhat higher relative cost, a 0.2 microseconds memory could be developed for completion in mid-1961. The problems which have occurred in the drive circuits and in film uniformity are rapidly being solved. Deposited conductors, low drive materials, and improved drivers will make this system cost competitive with present memories by late 1962. A commercial machine prototype incorporating a thin-film memory will probably be made by 1964. No other static memory system is known that has equally high-speed potential. A non-destructive read-out at better than 0.1 microseconds is feasible.

Cryogenic Memories. The "persistron" and the "trapped flux" memory techniques will provide 1 microseconds cycles at reasonably low power. Extreme density will be obtained. Problems now exist in uniformity of deposited elements. It is doubtful that cryogenic memories will appear in a commercial prototype machine before 1967. When it does appear, it will probably be a small, low-cost system with highly parallel operation to provide very large machine capability.

Color-radiation. Information on color memories indicates serious input-output problems. Present speed falls in the 10 microseconds to one microseconds range, with low cost and high density.

Multiaperture Magnetics. This approach is ideal for specialty memory applications where versatility or speed subordinate cost. The future will see drastic cost reduction by electrodeposition of memory planes, thermal spraying of ferrites to form planes, and deposited circuits to reduce wiring problems. Such a memory is ready for prototype machine development now. New fabrication techniques could be ready in one year with sufficient development effort.

Ferroelectric. The ferroelectric approach to memories seems doomed to failure. Such a system would have competed with magnetics had a good material been found; however, better magnetic systems than could be realized with a good ferroelectric material are now in the offing.

Luminescent. Possibilities for photodiode or photoresistor luminescent combinations exist. The major efforts now are for display systems with a built-in memory feature. These are beginning to reach the market and should reach maturity in about three years, when a move into the memory area might be expected. Features of interest will be small-size, high density, and possibly low cost. Speeds may be limited to 10 microseconds, but fast photodiodes could push beyond this. With such a system, the memory contents could be photographed at any stage and reinserted by exposure to the same light pattern.

Diode Capacitor. This very high-speed memory will probably be revitalized by manufacturing techniques which will bring costs in line. One to 10 millimicrosecond cycles, with high packing densities, are expected. It should be ready for prototype machines in two to three years.

Drum and Disc. Advances in packing density (3000 bits/inch) resulting from air-floating heads and improved magnetic coatings promise multi-megabit storage with 10 microseconds access within two years at very low cost (a few hundredths of a cent per bit).

Tape. A tape system with 3000 bits per inch was announced recently. Significant further improvements are not expected. Reliability and cost will be better.

Tube. Charge storage techniques, with electron beam positioning for selection, still represent a contender for high-speed, random-access memories. The cost is comparable to core storage, and the speed is better. But to maintain a competitive position, tubes need considerable improvement in beam positioning and bit density. Although low-power feedback techniques for accurate beam positioning will probably be developed, a breakthrough in this area is not expected.

Cryosar. The cryosar is a low-temperature semiconductor which shows a negative resistance characteristic, due to impurity ionization conduction phenomena. It will be important to any low-temperature circuits, including memory. It can be deposited because a single crystal is not required. Remarks concerning cryogenic memories are also applicable here.

Cryotron. This is a superconductive logic element with speed possibilities of about one microsecond. Low cost, low power, high packing density are its chief advantages. See cryosar and cryogenic memories above.

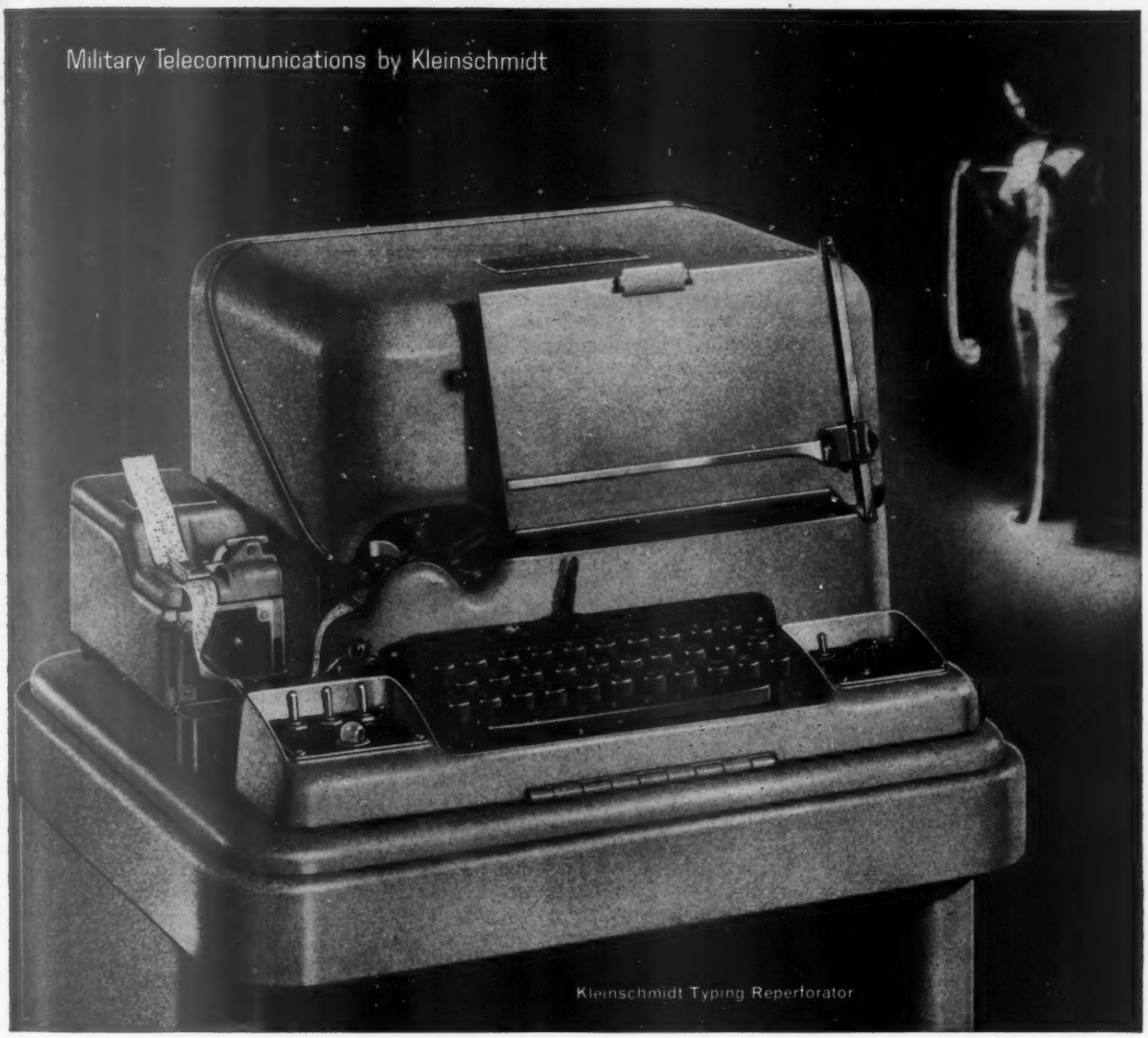
Tunnel Diode. Although a negative resistance characteristic is observed, and low prices are predicted, this is a two-terminal device which will require new circuits development. Suitable units are available. Circuit progress is being made. A prototype machine could incorporate this device in 1961.

Parametron Devices. The parametron approach will usually take a fair amount of power at frequencies of 10 to 100 times the data frequency. Various methods are being studied:

(1) Ferrite Core. A Japanese prototype is now being made. It is a megacycle carrier with a 10KC data rate. Its cost is low, its reliability high.

(2) Thin Film. A 100 megacycle carrier for a one megacycle data rate characterizes this approach, which could be pushed by a factor of ten. It may also hit in the x-band. Prototypes in the lower frequencies should come in about six years.

(3) Variable Capacitance Devices



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(Diodes). These are definitely x-band devices which could make 100 megacycle data rate possible. A military prototype could possibly be made in 1963, a commercial by 1966.

Twistor. The twistor can be used for a diodeless shift register. Other logic possibilities have not been thoroughly analyzed. The use of the magnetic threshold to eliminate diodes slows the operation time quite a lot. One hundred KC may be expected, as well as low cost and high reliability. The twistor could be developed by 1961 for prototype in 1962.

Thin Film. Extensive work at several companies has shown feasibility of the domain switching concept to logical operations. At least one-megacycle operation is possible, plus high reliability and quite reasonable cost. Technique development should be far enough along by 1962 to start military prototype machine development; commercial should be completed in 1965.

Diodeless Cores and Multiaperture. Very high reliability, 100 KC speed, eventual low cost spell early success, the prototype possibly by 1961 in design, built by 1962. Servicing problems associated with magnetics can be solved by modularization into disposable units.

Unit Documents. The problem in introducing a new unit document is largely a matter of accessory handling equipment for (1) entering information on the unit, (2) sorting, (3) collating, (4) reading, and occasionally (5) tabulating. Because of the need for this equipment, it is not likely that a new unit document will surprise the market, nor will acceptance be predictable.

Magnetic Tape. A 3000 bit-per-inch system has been announced. Improvements will be toward lower cost, possibly by electrodeposition, and toward increased reliability. Much work is going on in both areas as well as in tape selection.

High-Speed Printers

1. Stromberg-Carlson. Charactron tube to a selenium drum to paper. On the market in 1957.

2. A. B. Dick. Cathode ray tube (through pins) to chargeable drum to paper. Announced in 1959.

3. Burroughs Corporation. Directly charged paper. Applied in a weather high-speed printer (Whippet).

Character-recognition. Three basic types are actively being developed:

1. Magnetic. Numeric completed, but alphameric is encountering problems because of bulkiness of magnetic pick-up heads. Solutions expected soon.

2. Photoelectric. Same problems of decoding as magnetic system. Reading is an optical problem, and is more easily solved, but probably harder to produce.

3. Perceptron. A self-learning machine concept that will revolutionize input whenever hardware can be developed that will make the mathematical concept realizable. The chemical systems offer a possibility in this direction. Optical systems are a dark horse contender.

Made-in-place Components. Individual techniques are known and are in use except on single crystal devices, but these techniques so far have not been satisfactory for reasonable-sized modules. Surface protection improvements are needed, as well as edge definition. Resistors and capacitors will be the first to appear economically. Several companies already market combinations of these devices, tied in with standard transistors and diodes, but the price is high. The year 1962 ought to see this method of fabrication on an economical basis with present techniques; the logistics problem will be less severe.

Solid Circuits. Although this is a manufacturing development, operational improvements will be realized primarily in increased speed and lower power consumption. Problems are in accurate dimensional control, material purity, and micro-photo-etching. Packaging also will slow this development down. In 1961 these units (flip-flops, etc.) of silicon should be available at about three times the present unit cost. The yield problem will largely determine this availability. Ultimately solid circuits are expected to be competitive with present circuits.

Magnetic Components. Electroformed read-record heads are already in development and appear to offer a significant cost reduction. Bimags, multiapertures, and twistors will follow in a year, if pushed.

Vacuum Deposition. This technique, applied to magnetic thin films and associated equipment, will allow an entire memory plane or logic plane to be assembled in about two operations. Development of these techniques will be completed in 1960 and could be used in 1961 for prototype machines.

Microcircuits. Electron beam circuit formation in the superconductor field has received some attention at MIT. The development of techniques will come in ten years.

The following is concerned with an analysis of the problems a computer must solve and their formulation into machine specifications. Those working in this area must determine information flow patterns and must specify subsystems. They must also compose the complete logic design for the entire system.

It is in this area that one hears of self-organizing systems, learning machines, self-healing systems, and so on. These are a long way off. Now we are seeing a push in the area of man-machine communications. Program compilers or translators will soon be a part of every system. Machine-machine communications will come next with UNCOL (*Uni*versal *C*omputer-oriented *L*anguage), or some similar system.

Information retrieval methods will be developed as large-capacity data storage techniques become available. Parallel logic and arithmetic systems with internal multiplexing will be evolved to handle complex problems, and methods of dealing with high-order matrix inversions will be developed.

These accomplishments should be achieved within the next ten years, along with complete character-recognition systems to handle typed input data. Marginal in this period is the speech-to-machine data translation.

The Broad View

Research is often encountered today on "machine description" through algorithms or statistical techniques. In the next decade it is expected that synthetic design will be possible for entire computers. This should lead to the adaptive, self-healing, learning systems. Ultimately, machines which generalize will provide a very interesting tool. Work has already been done on simple geometry problems; however, it is a long way to the more general machine with logical powers.

Throughout the development history of new computing machines, as in many other technical areas, there is a flow from the basic sciences, through the components and techniques effort, into the final systems. Compared to past history, this is a very rapid flow. If a particular advance is needed five to ten years from now, appropriate research—not machine development—should be initiated at this time.

In the next decade the computer business; as seen from the outside, will be providing machines that will appear infinitely more simple and easier to operate, largely because of the effort on man-machine communications. At the same time they will be more powerful, due to greater logical depth or parallelism. Concurrent with these advantages, the cost, it is hoped, will remain the same, and the size will be reduced by the rapidly moving components and fabrication-techniques efforts.

New missions for the Agena

The Lockheed-built Agena satellite—used by the U.S. Air Force in its Discoverer, Midas, and Samos programs—has been chosen for another major program. The National Aeronautics and Space Administration plans to use a larger, more powerful version, the Agena B. NASA will use both Atlas and Thor boosters to launch it. Atop the Atlas, the versatile Agena B will vary from a 5000-pound earth satellite to an 800-pound space vehicle. Atop the Thor, it will be used for a new series of 1500-pound meteorological satellites. Lockheed is prime contractor and system manager for the Agena and Agena B.

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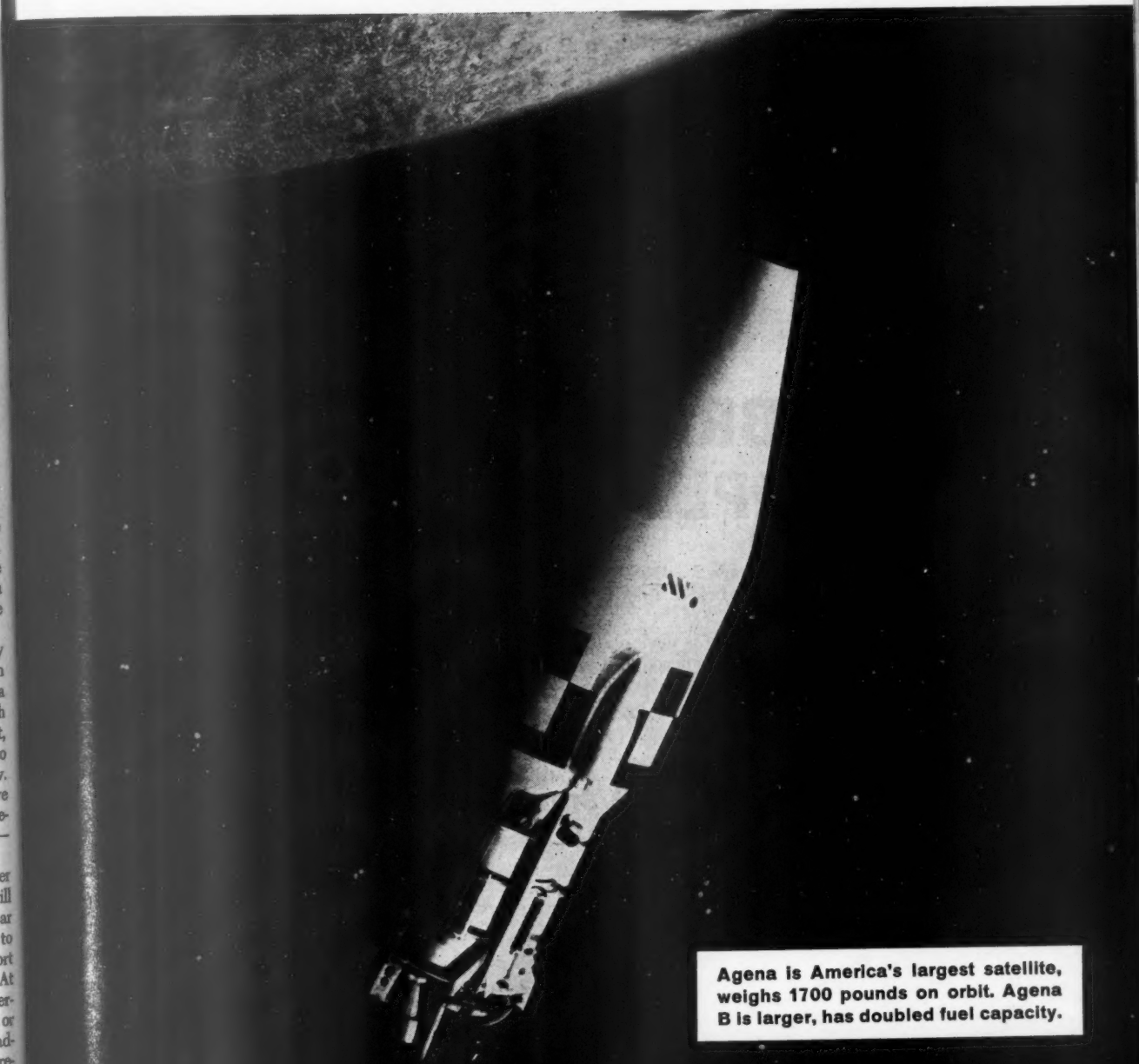

Agena is America's largest satellite, weighs 1700 pounds on orbit. Agena B is larger, has doubled fuel capacity.

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SPECIAL REPORT

How ADP Cuts Depot Costs

MODERN electronic data-processing methods applied to highly complicated management and operational procedures at the Air Materiel Command's Dayton Air Force Depot are resulting in the type of cost reduction that save American taxpayers a lot of money every year.

Provisioning document, or bill of materiel processing, is one area where these reductions are significant and impressive. Once a time-consuming, tedious, and excessively expensive manual chore, this job is now being done with greater speed, and accuracy, for less cost on the Depot's large-scale Remington Rand Univac system.

Dayton Air Force Depot is the sole source for all USAF airborne radio and navigational radar equipment, electronic counter-measures, test equipment, and all common parts for airborne and ground electronic systems.

Provisioning is concerned with the fact that most equipment items bought for the USAF are subject to repair either after a set number of operating hours, or when they break down.

To ensure that weapons systems do not break down, spares are purchased with those needed for operational use, and are deployed to provide replacements where needed. Spare parts must also be obtained during initial procurement to provide repair support following the introduction of new items to the operating inventory.

It is in determining initial support requirements that Dayton Air Force Depot has achieved significant success with its Univac system. Besides airborne radio and radar equipment, and test equipment of every type needed by the Air Force, DAFD has the prime responsibility for the procurement, storage, and issue of all common electronic items.

All bills of materiel for equipment involving such parts must be reviewed at DAFD to establish the range of maintenance parts required, to compute the initial support quantities, to check current assets of these items, and to prepare a buy-order for the net requirements.

The method used earlier was to take each provisioning document, and manually underscore bits and pieces for which the Depot was responsible. These were identified on the document by Federal or Air property class code and the manufacturer's part number.

The stock number was determined by manually looking for each part number in a sequenced tub file of over 200,000 cards. This laborious job could not always be completed in time, so many documents passed through without review and quantities suggested by the supplier were accepted without study.

Clerks performing the identification were also responsible for maintaining the huge file. The card file's current status was under suspicion, in spite of it's representing a capital investment and involved considerable upkeep cost.

When a matching card was found for an item on the provisioning document, the current AF/FED stock number was manually transcribed to the document, which was then passed progressively through each property class. In each case, property specialists went through the complete document, which might contain several thousand items, and made individual computations of intitial support requirements for their items based on wear-out rates, number of items to be bought, the number of times each part appeared in the system being procured, and the anticipated deployment.

Current assets were balanced against this figure, and net quantities to be bought transcribed to the document. Complete review of the entire document had to be made in each class, with attendant errors.

What Univac Does

Finally, all data of items bought were typed upon an order form for submission to the contracting agency. When a review was not completed, due to time limitations and workload, many buys of excessive quantities, non-preferred items, (and sometimes deficient quantities) were made.

With Univac, a punched card is prepared for each item on the document that falls in a class prime at DAFD. Cards are collected and automatically converted to magnetic tape at high speed.

Data in the old manual card file has been converted to magnetic tape, and now comprises 400,000 manufacturers' part numbers cross-referenced to the current Fed/AF stock number. Other pertinent information such as the average wearout rate, stock list price, status code, and contractor's identification code has been added to each item in the file.

All input items from documents are processed by the computer against this file, the current stock number obtained, initial support requirements computed, and lists prepared by property class of both indentified and new items.

File maintenance is performed by the computer, so that it is always current. Lists of identified items are sent to each property class, where assets are applied against these new requirements to establish the net buy quantity.

Five Figure Savings

Manufacturers' part numbers without stock numbers are submitted to cataloging for the assignment of appropriate numbers. Each property class reviews only its own items.

Annual personnel savings in the high five dollar figures have resulted from conversion to electronic data-processing equipment. Intangible benefits would include:

(1) Timely, thorough, and accurate processing of all documents. (2) Prompt cataloging action. Notification of stock number assignments to DAFD suppliers results in earlier receipt of these items, as delivery schedules cannot be met unless stock numbers are furnished. (3) Range of spares is now more complete.

Also, (4) Only preferred items are procured, as those in a non-preferred status are cross-referenced by the computer to the preferred item. (5) File maintenance has been reduced to a timely and relatively easy operation. (6) Items purchased are immediately carried in the due-in record, also maintained on Univac.

Items common to different equip-

ment are now coded on the master file so that when a new provisioning requirement is set, the quantity is accumulated for 90 days with other like items.

During this period there may be from 5000 to 10,000 of these common spare parts appearing on as many as 50 documents each. By making an accumulative buy, the USAF takes advantage of quantity prices as well as a reduction in administrative costs due to fewer procurement contracts to process.

From this sampling it can be seen that a direct benefit in excess of $10-million annually is now being realized, with a reduction in administrative costs which cannot be properly and accurately evaluated in dollars.

The master file of cross-referenced manufacturers' part numbers and AF/-Fed stock numbers has another worthwhile use. DAFD publishes handbooks and technical orders for use by field personnel when ordering spare parts. Identification of the parts is by the original manufacturer's part number.

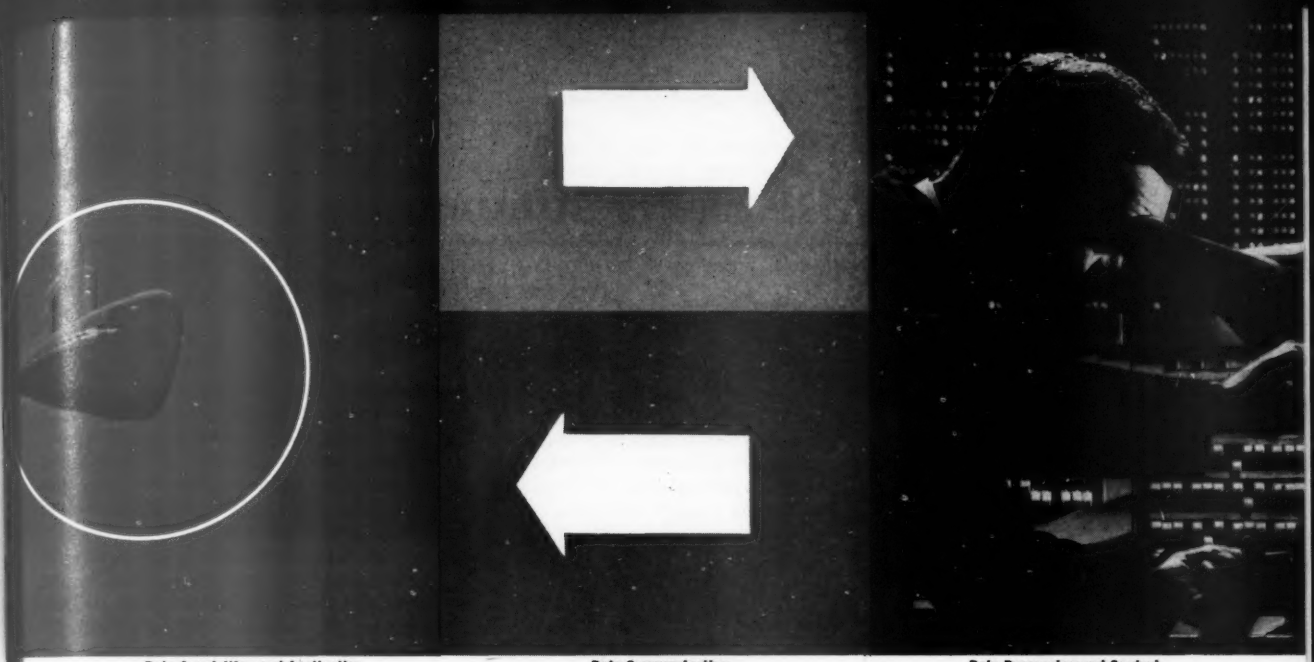
More Work Ahead

DAFD has set up a project to convert all this handbook data to magnetic tape so that cataloging changes can be applied as they occur, and current handbook data supplied on demand. This same file will also provide information relating to the application of all spare parts to the component or end items they support, essential in determining whether to dispose of an item, who the possible users are, and in supportability studies. Dayton has also used it to produce interim handbooks on new equipments when the supplier defaulted in this regard.

As this catalog review work is being done on the Univac computer system while processing provisioning documents without increasing its running time, the only costs involved are in punching input cards and the cataloging review.

Supply tables which establish intital support stocks at organizational levels are now prepared on the Univac system when provisioning documents are prepared. This represents a much improved service, rather than significant dollar savings.

Materiel standards cards for use in establishing depot maintenance operating stocks will also have their genesis in the screening of provisioning documents. This demonstrates the fact that an inter-dependency of several depot procedural systems exists which will eventually be molded into an integrated data-processing function that will affect almost every depot operation.



Data Acquisition and Application | Data Communication | Data Processing and Control

The 3 elements of an automated military system: all systems integration capabilities of IBM

This three-way capability makes IBM's Federal Systems Division the logical choice to handle study or development contracts—or to assume total systems integration responsibility.

IBM recognizes the importance of the fiduciary relationship that must exist between the prime contractor and the government. Through a continuing policy of customer service, IBM has gained a reputation for looking at problems through the customer's eyes. The Federal Systems Division is organized to bring this capability to a wide range of government requirements.

In data acquisition and application subsystems—IBM has the manpower and know-how to develop and furnish sensors, displays, and other devices for man-to-application, and machine-to-application communications.

In data communication subsystems—With knowledge and experience in IBM Tele-processing*, Federal Systems has the capabilities needed to design and develop complete networks to meet systems requirements. This includes, for example, subsystems with message-switching functions and terminal instrumentation. Message-processing equipment, inquiry stations, and code modulation-demodulation equipment are being further developed in the Division's laboratories.

In data processing and control subsystems—Engineers and scientists at the Federal Systems Division can draw on a vast IBM background in data processing to develop new and advanced systems and programming concepts. They can take existing equipment, or utilize widespread manufacturing facilities to meet both the development and production requirements of totally new instrumentation.

The three elements of a military system are all logical capabilities of IBM's Federal Systems Division—for development *and* systems integration.

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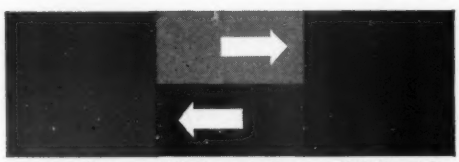

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ADP News Roundup

Computer Interchange Provided Navy Lab

Computers manufactured by two different firms are "talking" to each other in common mathematical language at the Navy's David Taylor Model Basin.

Key to the new system is a ZA-100 Computer Language Translator, manufactured by Electronic Engineering Company of California. The ZA-100 performs 13 electronic data translations and is the largest such machine to be delivered by the company to date.

Interchange of data is between an IBM 704 and a Remington Rand Univac.

Translating equally well from Univac to 704 or vice versa, the ZA-100 will also translate analog or binary data from hydro-mechanical and structural tests and spectrum analysis data into either of two computer formats.

RANDID Read-Out Device Developed by Hazeltine

Rapid Alpha Numeric Digital Indicating Device—RANDID for short—a versatile new read-out device, has been developed by Hazeltine Corp.

Characters or symbols to be displayed by RANDID photographically reproduced on the belt and appear as transparent characters on an opaque background. Code tracks, similarly reproduced on the belt, provide binary coded identification of each character.

By scanning code tracks with incandescent lamps and phototransistors, a code signal is generated identifying location of each character on the belt.

RANDID can be used where a multi-window, multi-line display is required. Applications include: Aircraft Panel Display, Digital Data Transmission Monitor, Card or Tape/reader/-verifier, Visual Decoder, Information Retrieval Display, Computer Readout, Small Tote Board, Test Equipment Readout and others.

Characters in a given display window are displayed when the generated binary code signal corresponding to the selected character and display position agree with the binary code of the input. When the two codes agree, a high intensity neon lamp is fired and stroboscopically illuminates the selected character. Transistorized circuits affording electronic storage facilities, code comparison and strobe drivers are contained in a unit which can be located remotely from the display unit.

Electronic storage facilities allow RANDID to accept input information in either dc or pulse binary-coded decimal form and permit non-destructive read-out of the displayed information.

Global Supply System Unveiled by Army

A new electronic supply system that will save half-million dollars a month and process requisitions for Transportation Corps aircraft, marine and railway equipment five times faster than previous methods has been unveiled by the Army.

Located at Army's Transportation Materiel Command in St. Louis, the computer system operates over wire and radio circuits covering the entire United States and four other continents. The computer handles over a 1,000 requisitions daily for parts and equipment against a $780-million inventory.

Full processing cycle formerly took about two weeks, and now, using the IBM 705 III, gets material moving in less than 72 hours. According to TMC Commander Brig. Gen. William B. Bunker, "the ability to handle orders faster will enable us to work with smaller inventories. In turn, this will reduce losses due to obsolescence. These factors are expected to save at least $6-million annually for the next three years." The computer has allowed TMC to merge into one master tape file the interrelated records of its six operating departments. Master tape file contains all of the needed records of maintenance engineering, cataloging and identification, material requirements, procurement and production, and depot supply activities and accounting. The big IBM machine automatically orders the requested part from the nearest supply depot to the requisitioner, thereby holding transportation cost to a minimum. The computer can also determine if a substitute part is in stock if the original requisition cannot be filled, order the substitute and print notification for the requisitioner of the action taken.

In filling requisitions, the computer examines up-dated records and warns of stocks too low or too high. Where stocks are needed, the IBM 705 III issues purchase orders.

Moderate Price Computer Introduced by Honeywell

A computer that may make high-speed electronic data processing practical for over 6,000 of the 10,000 top companies in the U.S. has been introduced by DATAmatic Division of Minneapolis-Honeywell.

Company officials describe the Honeywell 400 as "the new generation" computer which will be the "most powerful available in the moderate-price field."

Operating up to 10 times as fast as existing models in its price range, the Honeywell 400 will provide "more data processing per dollar spent than any previous equipment of similar size," according to company officials. To use industry's fastest and most reliable magnetic tapes, the new system will also have the fastest printing and sorting speeds.

Available next summer, the 400 will rent for $8,660 a month. Rental includes central processor, four high-speed magnetic tape units, a high-speed printer and a card reader.

Central processor of the 400 operates at internal speeds up to 6,000 operations, such as additions or subtractions, per second. Core memory capacity will be 1,024 words of 48 bits each. Information passing through the central processor will be checked internally as it is read from or written on magnetic tape.

This system will be able to perform both reading and writing operations simultaneously, and high-speed printing can be performed simultaneously with any other operation. Information transfer rate to or from the tapes will

be 64,000 characters or 96,000 decimal digits per second. The high-speed printer operates at 900 lines per minute while the card reader handles 650 cards per minute.

Navy Supply Operations Aided by Burroughs 220

The largest single supply activity in the western hemisphere has been converted to a Burroughs 220 electronic data processing system.

The system is installed at Naval Supply Center in Norfolk, Va., and will serve as the data handling control in the distribution system center there.

Naval Supply Center receives over 200,000 request documents and ships out over 145,000 measurement tons of supplies and equipment in an average month. The Burroughs 220 will provide routine decisions automatically, will determine availability of items requested, will create shipping invoices, and update stock and financial records.

Also, it will provide integrated personnel accounting and print up-to-the-minute reports to facilitate executive decisions.

The new system provides electronic management-by-exception. During processing, the computer checks all input against regulations governing given transactions.

Finding exception conditions, the computer prints an exception notification card which are sent to stock analysts, assuring that non-routine problems get immediate attention. "The effect of the Burroughs 220 will be to re-apply human resources to critical and complex problems," according to Cdr. R. A. Williams, Data Processing Officer.

Keeping an updated record of Center activity, the Burroughs magnetic tape system will produce issue documents, transaction listings, stock and financial inventory control records and regular management reports.

New Systems Announced By Royal McBee

A new, modular electronic data processing system and an automatic sequence controlled computer typewriter have been announced by Royal McBee Corp.

The former—RPC-9000—is the latest product of the Royal Precision Corp. It incorporates many advanced computer design features and provides automatic in-line records-processing, a new concept in electronic data processing. Data is accepted in random order, and all affected records are automatically up-dated in a single uninterrupted sequence.

The automatic sequence controlled computer typewriter will provide optimum automation to billing and many other office routines. Designated the 910 Computer Typewriter, the machine automatically types all extensions, subtotals, and totals.

Description of taxes, discounts, and rates, plus allied calculations are also automatically printed, without recourse to manual keystrokes, through stored program control.

Computer System Set For Navy Scientists

Control Data Corporation has been awarded a Naval Air Material Center contract to deliver one of its large 1604 computer systems to a data processing center located at a leading university.

The computer will be a part of a combined Navy/Air Force/National Aeronautics and Space Administration facility for evaluating and formulating aircraft structural design criteria.

Flight maneuver load data will be recorded on magnetic tape during the course of a world-wide evaluation of various aircraft types. Recorded tapes will then be sent to the processing center, administered by the Aeronautical Structures Laboratory of NAMC for evaluation.

Minuteman Testing Aided By Analog Recorder

Boeing Airplane Co. has selected a solid-state ground analog recorder as the primary recorder/reproducer of a telemetry ground station for testing of the Minuteman missile.

This unit, produced by Ampex Corporation, will be the primary part of a system that will record signals of the testing of the missile, of the period immediately prior to missile launching, and during missile launch and flight.

Information can be transmitted to the recorder up to 350,000 bits per second. Tape recorded data will be the primary information source to a tape format converter. Information will pulse-code-modulated and frequency-modulated telemetry data. The tape also provides high speed data search, air guiding, voice monitoring and rugged structure.

Another Philco achievement in global communications

As part of a major study of space communications techniques, Philco is prime contractor for an Air Force project to relay high frequency radio communications around the curvature of the earth, through space. Known as the Passive Satellite Relay Link, it will reflect voice and teletype signals from a 100 ft. aluminum-skinned plastic balloon. Under NASA's Project Echo, the balloon is to be launched into a 1,000 mile earth orbit for use as a passive communications reflector.

The parametric amplifiers, receiving antennas, and tracking and receiving systems are Philco designed, built and installed. The entire program is managed by Philco, under the supervision of the Communications Directorate, Rome Air Development Center.

This is one more step in man's utilization of outer space . . . and another important Philco achievement in global communications. For capacity, facilities and experience in advanced electronic systems, look to the leader . . . look to Philco.

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Research Rundown

FURTHER STEP DOWN THE ANTI-MISSILE MISSILE ROAD came recently with Army successfully knocking down a Corporal with a Nike-Hercules. Using a new kind of radar, the test Hercules is said to have "three-times the capability of existing operational versions. The test marked the first kill of a ballistic missile by another rocket, although a previous test saw Hawk knock out Honest John, an unguided artillery rocket.

FOURTEEN RAILROADS FOR MINUTEMAN TESTING this summer would appear to cover just about all of the track in the U.S. west of the Mississippi. Main goal of the tests will lie in such areas as communications, control, logistic support and environmental conditions. Missiles will not be carried.

ACCURATE TRACKING RADAR FOR BMEWS still hasn't been developed, and there is no money in the fiscal 1961 budget to cover such development. "A rough analysis of the nature and direction" of incoming is about the best the current system will be able to provide until some work is done in this area. What anti-missile men will have to work with: an "elliptical region" of the continent that's being shot at.

SCATTER COMMUNICATIONS IN THE PACIFIC ARE PLEASING ARMY, offer nearly "trouble-free" operations over a 6,500 mi. system. Using techniques of ionospheric and tropospheric scatter propagation, the new system is said to yield up to 99% reliability for Army users.

BOUNDARY LAYER CONTROL FOR THE C-130 looks more and more promising at tests progress. Stall speed on the big plane has been cut to 55 knots (from 84), engine-out minimum control speed is down from 98 to 68 knots. Most likely bet: that Lockheed will get an extension of bailment on the Air Force plane beyond the end of June, when it was due to expire.

COMBINED MISSILE PACKING CASES/LAUNCHING TUBES have been successfully developed by Army's Ordnance Missile Command. Using plastics, the tubes are tough, resiliant and cheap. After missile shipment, the containers are simply opened at one end, the missile fired, and the container/tube discarded.

OUTRIGHT OBSOLESCENCE FOR THE USSR'S FIGHTER AIRCRAFT force—some 10,000 planes—would be one result of a fully successful development program on the B-70 bomber—given enough money to finish it up in a hurry. The reason: operating at U-2 altitudes, the B-70 would be just as invulnerable to attack by the Russian planes. Added benefit: what might be politely called a crimp in Mr. Khrushchev's budget planning.

STUMBLING START FOR THE SACLANT ASW CENTER was partially to be expected, besides being symptomatic of a general lag in NATO support cooperation. Soon to-be-signed multi-lateral agreement on such details as patent rights will help to clear the underbrush, should start the snowball rolling on what has been not much more than an administrative blizzard.

Concurrency Stressed In CCDD Organization

An integrated approach to air defense electronics problems will be one of the most important services offered by the new Air Research and Development Command and Control Development Division at Hanscom Field, Mass.

Drawing on lessons learned in the Air Defense Systems Integration Division and Ballistic Missile Division, CCDD Commander Maj. Gen. Kenneth P. Berquist has said that "traditional odds-and-ends black box procurement" is not good enough for current Air Force use. He said, "The environment must be analyzed, designed, and implemented as a system—the developer (ARDC), logistician (AMC), and operator (ADC) getting together early and remaining together."

To do this at CCDD, the ARDC managed organization will include a new Command and Control Systems Office, headed by Brig. Gen. Loren G. McCollom, which will insure Air Defense Command is represented in planning electronic systems. AMC will also be represented.

Aiding these military entities and getting the job done will be Mitre established a year and a half ago to act in management advisory capacity to ADSID.

Berquist said, "We are now concentrating our management of ground electronics on command and control systems. They will be grouped under CCDD direction at Hanscom Field. The systems management directorate is a grouping of 13 "L" systems projects offices. It is the directorate which manages and directs the command and control systems."

ONR Investigates New Land Vehicle

Office of Naval Research has sponsored development work on a new concept and overland vehicles which combines the rough terrain abilities of track vehicles and the highway speeds of tired vehicles.

Developed by Borg-Warner, the Airoil or land vehicle uses what amounts to a standard track drive powering a track composed of rubber tires. Capable of better-than-track performance over rough terrain, the Airoil vehicle test bed cruises up to 45 mph on paved surfaces.

ONR feels that the Airoil principle could be applied to a family of vehicles from ¾ ton carrying capacity on up. The test bed, in weight, corresponded to the standard 4 by 6 2½ ton truck.

When operating under power, the wheels which serve as "tracks" turn when they reach the ground, thereby increasing the road speed. Beyond the sponsorship provided by ONR, Army Engineers have expressed an interest in the vehicle. However, as it stands now, there is no one to pick up the development of a more perfect and usable vehicle. Full development costs are estimated by ONR as being about $3- to $5-million.

Using what are basically available parts, the Airoil vehicle offers further advantage in that it requires no suspension system. This means that initial cash outlay for a given vehicle of this type would be up to 30-35% less than for a comparable track vehicle.

Full-Time ASW Work Seen For Helicopters

Navy helicopters using an automatic hover-coupler have given the fleet its first big step towards 24 hour ASW capacity for helicopters.

The new hover-coupler gear and automatic flight control was introduced to the fleet 18 months ago with the HSS-1N.

While Navy admits that transfer from flight to hover still poses problems, they add that the hover-coupler can hold the helicopter on an into-the-wind heading at 100 ft. altitude and ground speed of 40 knots.

The current Sikorsky HSS-1N has cruise speeds to submarine contacts of 100 knots, and using a dipping sonar system it can provide screens or area searches.

Undersea Research Vehicle To Operate Remotely

RUM—for Remote Underwater Manipulator—a unique remote control undersea vehicle for exploring and conducting scientific oceanic studies at great depths has been developed for Office of Naval Research.

The vehicle is basically a tank with a long, pointed manipulator arm and hand, and specially devised underwater television cameras which act as eyes for the vehicle's operator on shore.

RUM will provide Navy with a vehicle that can perform controlled-work functions and oceanographic research, including sea floor observation, specimen collection and assembly and installation of deep bottom-mounted instrumentation.

The present RUM vehicle is primarily geared to prove feasibility of a more advanced version. Such an advanced version could conceivably include a sort of underwater helicopter arrangement to lift it over obstacles. The more advanced version would be constructed largely of aluminum, using the standard four-pitch, 30-inch rubber band type track used on the Army M-76 vehicle. It would be a few thousand pounds lighter than the experimental RUM, more efficient, more reliable and less subject to stress.

Toxics Research Assigned to ARPA

Advanced Research Projects Agency has assumed general direction of toxicological research in Defense Department, according to Defense Director of Research and Engineering, Herbert F. York.

Primary work in this area will be handled by Army Chemical Center Laboratories with advice and assistance of National Academy of Sciences, National Research Council Advisory Center of Toxicology, and Office of Science, DDRE.

The program includes work on new chemical products which may incidentally be a hazard to health under working conditions. Investigations will include determination of toxicity degree, allowable concentrations, incapacitating thresholds and effective antidotes. Chemical warfare agents are specifically ruled out of these studies.

Initial funding by ARPA will be about $500,000. Separate military services will continue to be responsible for finding environmental and occupational health hazards peculiar to their own activities.

ARPA will provide coordination of the expanding program to meet the needs of the services and to insure top efficiency and economy of operation.

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TUES.
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Transpacific flights..... 10
Latin American flights... 52
Round-the-world flights . 2

WED.
Transatlantic flights..... 18
Transpacific flights..... 14
Latin American flights... 58
Round-the-world flights . 2

THURS.
Transatlantic flights..... 16
Transpacific flights..... 8
Latin American flights... 60
Round-the-world flights . 2

FRI.
Transatlantic flights..... 22
Transpacific flights..... 14
Latin American flights... 50
Round-the-world flights . 2

SAT.
Transatlantic flights..... 20
Transpacific flights..... 10
Latin American flights... 70
Round-the-world flights . 1

SUN.
Transatlantic flights..... 16
Transpacific flights..... 12
Latin American flights... 50
Round-the-world flights . 1

PAN AM JET CLIPPER CARGO

via the WORLD'S MOST EXPERIENCED AIRLINE

PAN AM

nel, weapons, tools and equipment of the engineer squad may be dictated by future warfare concepts.

Also, such a tractor would air transportable and air droppable, highly mobile, amphibious and capable of heavy work. To replace present tractors, bulldozers, scrapers, graders, loaders, prime movers and dump trucks, the unit would be the principle item of engineer working equipment.

To this end, Army Engineer Research and Development Laboratories are working on the All-Purpose Ballastable Crawler (ABC). The unit is projected as a track vehicle with a front loading scraper bowl and front mounted dozer, with a basic weight of about 20,000 lbs. The unit could be ballasted with earth to a working weight of about 40,000 lbs., to double its work capacity for such operations as bulldozing and prime moving.

Top speed of the ABC would be about 30 mph. The suspension system will give flexible suspension for high speed work, and may be locked out for slow speed work to prevent wash boarding during scraping, dozing and grading. To increase versatility of ABC, attachments such as winches, cranes, augers, ditchers and so on will be developed. First prototype tests are set for this summer.

Kaman Drone Copter Shown to Conference

A Kaman Aircraft Corp. radio-controlled helicopter has been demonstrated before Chiefs of Naval Operations of Latin American countries at the recent Inter-American Naval Conference held at Key West, Fla.

The HTK drone carried two dummy torpedoes and was guided by radio signals sent from a control station on the USS Hazlewood to a target where, on command, it dropped its weapon. Such a helicopter would be used in connection with the DASH (Drone Anti-Submarine Helicopter) concept, which uses drone helicopters to increase the stand-off range of mothership destroyers.

The Inter-American Naval Conference was held to show Latin American Navies the latest equipment and techniques in Anti-Submarine Warfare, as well as to seek means of cooperation in the protection of American shorelines.

The Kaman drone can be flown by persons without previous pilot experience who have had only a few hours of instruction. Winch-down techniques make it possible to effect landing on pitching decks and have been accomplished in winds of more than 30 knots and with 25° roll on the mother ship.

Besides weapons, the Kaman drone can carry detection equipment to either search submarines, report damages or to measure radioactive air content.

Industry Developments

Pod-Mounted Jet Aids Helicopters

An economical way of increasing speed, lift, range and versatility of military helicopters by using a detachable, pod-mounted jet engine has been displayed by the Kaman Aircraft Corp.

Kaman says the technique could be ready for flight testing on a Kaman HU2K in six months without major development expense. Used on this helicopter, the pod-mounted jet would increase speed 40%, or lift 20%, or range 17%, besides improving hovering and climb characteristics.

The jet engine used is already in production.

The jet pod would have a simple plug-in connector and could be attached or removed by two men in minutes. No major modifications in the helicopter would be required.

Jet stream could be pilot controlled or pre-set through rotation of the engine exhaust nozzle to give either maximum horizontal thrust for speed, vertical thrust for lift, or intermediate thrust to combine both.

Error-Free System Developed for Titan

An error-free communications system that "hangs underground" has been developed for the Air Force Titan program by International Telephone and Telegraph Corp.-Kellogg Division.

The system uses the first sub-surface switching apparatus in the entire missile and space program to launch Titan from underground silos. The system is suspended in caissons underground to provide high physical balance in shock waves and pressures resulting from possible enemy attack.

The system is designed so that the message always is completed, regardless of momentary situations, interference, interruption or elements of human error. The system is made up of eight distinct operations, including administrative communications, operational communications, page and countdown, camera control, fire alarm, operation direct line, maintenance and checkout, voice recording and range safety.

In My Opinion

(continued from page 15)

the central problem is and will continue to be the protection of our own strategic force from surprise attack. Certainly, anything that we can do to increase mobility and concealment of that strategic "counterstrike" force is of vital necessity.

The point is well made also that under conditions in which both sides in a so-called "tactical" situation have nuclear weapons, the result would probably be a decision not to use weapons on either side.

I am ever more convinced that we must restore our capability to defeat military forces of all types and character. We must have so-called "conventional," perhaps better described as "non-nuclear," forces to deal with less-than-nuclear assaults under the umbrella of mutual nuclear deterence.

Having said this, I wish to emphasize that the ultimate goal which every military officer should be keeping in mind is the achievement of an international security system in which weapon systems do not dominate policy, in which the huge armaments race could be reduced to a manageable effort to maintain strictly defensive forces of high calibre. Disarmament under conditions of inspection and control should be considered as absolutely paramount. Paradoxically, we very well may have to increase our conventional forces in order to be able to persuade the Communists to bargain and negotiate seriously for a reduction of their own conventional forces.

Hubert H. Humphrey
Senator from Minnesota

Congressional Comment

Thank you for . . . calling my attention to the article in ARMED FORCES MANAGEMENT entitled "Today's Military Strategy: Is it National Suicide?"

I hope to have an opportunity to read the article with strict attention soon. However, a quick glance at the opening paragraphs suggests that it requires some study before evaluating the views presented therein . . .

Gerald R. Ford, Jr.
Congressman from Michigan

Extra Copies

Extra copies of this issue are available for $1.00 each from The Editors, ARMED FORCES MANAGEMENT, 1001 Vermont Ave., NW, Washington 5, D.C. Cash, check or money order must accompany request.

Procurement Trends

SUPPLY IMPROVEMENT PROGRAM AT THIRD U.S. AIR FORCE in England is earning it praise as "probably the best Air Force supply operation in Europe." Procedure, evolved independently, has surprisingly similar philosophy to that of British Royal Navy's Work Study Team concept, may be expanded to all USAFE supply setups. Success of program in getting more done with less has been extremely impressive to almost all DCS/Materiel visitors who have watched it in operation.

GERMAN AIR FORCE WILL PROBABLY BUY about 100 of its total planned force of 600 to 700 F-104's from the U.S., about 30 of them the two-seat trainer version. Reason: German assembly line being set up to build their own "takes time to get going and we want to start aircraft integration before factory will be ready," i.e. in late '60 or early '61.

MAJOR HEADACHE FOR COMPUTER USERS currently stems from failure of peripheral equipment to keep technologically up with ultra-fast basic computer they must support. While newer, faster computers are being announced almost weekly, input/output devices are about the same as they have been for the past few years. This means either that the new computers have to rely on buffer equipment or operate at less than full speed—and it costs money either way.

RESUSTICATION OF THE B-70 CHEMICAL BOMBER as a full weapon system points down the road to further manned aircraft advances—an alley made blind by the decision to kill that program. All told, a budget of about $1-billion over the Administration request seems likely, with more thanks to Khrushchev than most anyone else. On the horizon, the question of being able to spend the appropriations is almost certain to crop up.

THE BEST WAY TO BUY AUTOMATIC DATA PROCESSING equipment, according to a recent Air Force study, is a combined rent-and-buy arrangement. The reasoning: buy the central processing unit, which can be amortized in about 20-24 months, then rent the peripheral equipment, because of its cheaper rates.

MAINTENANCE MONEY-SAVER FOR MISSILES has been worked out by Air Force at Vandenberg missile base, using automatic data processing. The key: when a missile goes "down" for any reason, the computer rapidly and automatically checks to see what's due in the way of routine maintenance, lets repair crews go ahead and handle routine work at the same time. Net result—minimum amount of lost operating time by sidestepping the next maintenance check.

MORE REALISTIC ON-THE-JOB MISSILE EXPERIENCE for missile trainees at Vandenberg is being accomplished using basically the same technique. One short computer run shows which class is up for a given phase of maintenance training when the job in question actually has to be done on the birds, trainees can look over the shoulders of the men doing the job, or actually take part in the repair work.

BOOST IN STATUS FOR AIR FORCE ADP results from recent formation of a new Directorate of Data Systems at Headquarters, Air Materiel Command. Work for the new office will cover evaluation of present and projected ADP work in AMC, liaison with industry, and approval of all ADP equipment brought into the command.

Contract Auditing Increased by Navy

Navy has told a Senate Armed Services Procurement Subcommittee that audits as an aid to pricing contracts has been increased two-fold in the past year.

Assistant Navy Secretary Cecil P. Milne told the subcommittee that auditing man-hours in reviews of initial pricing proposals doubled from the third quarter of fiscal 1959 to the second quarter of fiscal 1960. He said the figure would probably increase another 100% by this month.

In the second quarter of fiscal 1960, Milne said, Navy used 208,000 man-hours to audit actual contract costs.

Spares Purchase Policy Announced by Defense

Spares for delicate or critical military equipment will hereafter be purchased from original manufacturers insofar as practical, under Revision No. 54 of the Armed Services Procurement Regulation, dated 2 May, 1960.

In other changes to ASPR: a new subparagraph added to ASPR 3-403.3, plus an alternate contract provision in ASPR 7-109.7, for use where a follow-on contract is geared to a preceding agreement for pricing purposes.

This will provide retroactive and prospective price re-determination. Payment "for overtime and shift premiums" has been explained a new clause (ASPR 12-102.3c) for use in all contracts over $10,000 with exception of: (1) firm fixed-price contracts, (2) fixed-price agreements providing escalation excepting labor, (3) fixed-price contracts providing only prospective price redetermination. Appendices B and C have been revised to define "minor plant equipment" as an item valued under $200.

Revision 54 may be obtained from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., at 50¢ per copy.

Spending Breakdown Detailed by Defense

Defense Department has listed figures for the first three quarters of fiscal 1960, detailing funds obligated and money spent for procurement and research development test and evaluation. Total defense procurement obligations were $3.5-billion for aircraft; and $2.8-billion for missiles. Actual expenditures in these two areas were $5.1-billion and $3.2-billion respectively.

RDT&E obligations for the first three quarters were $161-million for aircraft; $959-million for missiles and $356-million for astronautics. Expenditures under RDT&E in these categories were: aircraft, $237-million; missiles, $157-million; and astronautics, $83-million.

Poor Quality Control Cited by Stroop

"Some of the failures of our most expensive missiles have stemmed from lack of quality in essentially civilian-type components," according to Rear Adm. Paul D. Stroop, Chief of the Navy Bureau of Weapons.

Stroop said, "Quality must be designed into a product; it can't be inspected into it." The Bureau chief said mass production, America's biggest asset in recent wars, may have become a liability where quality is needed.

Stroop said quality control experts developed their technique as a separate surveillance—removed from engineering and production themselves and only entering those realms when a product improvement was imperative. Thus, he said, much of our attention was focused on producing a product that would pass muster rather than having maximum quality built in from the start.

Stroop said, "we must improve initial specifications, production controls and feed-back of quality data before and during construction and design." Only by perfecting these methods he said, can we avoid "rejection of promising plans on too limited evidence, at the same time learning how to reject those unworthy ones which might skim through with a lucky sample or two."

Navy Buys Landing System For All-Weather Work

An electronic aircraft landing system to help provide all-weather operating capability for Navy's task forces has been ordered from Bell Aircraft Corp.

Under an initial $4.3-million contract, Bell will provide four AN/SPN-10 systems, three to be installed aboard aircraft carriers and one for pilot familiarization at a land base. Delivery is set to begin in 18 months.

AN/SPN-10 will provide vastly improved carrier-controlled approach capability through stabilized glide slope information, ship motion prediction and improved precision radar, Navy says. Using radar, radio and computers, the system can fly an airplane to touch down on a carrier deck without the pilot touching his controls. The system includes two radar antennas mounted on the carrier's superstructure to track incoming aircraft, two visual displays providing precise information about the aircraft location with respect to the carrier deck, and electronic computers which show whether the plane is on the proper course of descent.

Sky-Bolt Missile Bought by Britain

Defense Secretary Thomas Gates and British Defense Minister Harold Watkinson have signed an agreement under which Britain will purchase the Sky-Bolt air launched ballistic missile for its Air Force when that missile is available.

At the same time possible purchase of Polaris missiles for European defense will dominate the agenda of the 33 member Intrastructure Committee, one of NATO's most powerful financial groups here.

The NATO group is in this country for a 16-day visit to various military construction sites, manufacturing plants, missile ranges and military control centers.

One of the main purposes of the trip will be to study the Navy's Polaris missile for possible purchase as a NATO weapon. Most likely version would be ground launched copy of the Polaris missile. Current estimates are from "three to five years to an operational ground-launched Polaris."

Data Systems Office Established at AMC

Air Materiel Command has established a new Directorate of Data Systems, to deal with problems resulting from the growing importance of electroic data processing.

Still in the planning phase, the Directorate is head by Brig. Gen. F. C. Gideon, former Director of AMC Transportation. His directorate will be responsible for development and implementation of standard materiel data systems Air Force-wide and development and implementation of the logis-

ticstics management systems within Air Materiel Command.

Besides giving Air Force contractors a single point of contact for resolving problems related to processing and transmitting information between AMC and contractors, it will also give industry a single contact point within the AF.

The new directorate will also work with improvements in techniques, or use of advanced developments in operations, research and analysis. Finally the office will evaluate and select data communications processing equipment for the Air Force.

Communications Agency Nears Final Status

Last touches are being applied to the recently announced Defense-wide Communications Agency, to be headed by RAdm. William D. Irwin.

A timetable of about nine months has been set for final organizational work on the new agency. The Defense Communications System will furnish facilities for command and control functions, intelligence, weather, logistics and administration for Defense, besides those support functions formerly provided by the services for National Aeronautics and Space Administration.

A gradual phasing-in of control is planned to avoid rupture of present operations. From a hardware standpoint, the new system will include all worldwide long-haul Government-owned and leased, point-to-point circuits, terminals, control facilities and tributaries.

Aim of the new organization is to give Defense maximum communications for dollars investment, support for the more advances weapon systems of the future, maximum flexibility, adequate dispersion with alternate routing capacity, standard installation, operation and maintenance, and an end to duplication of efforts.

The chief of the new agency will report directly to the Secretary of Defense through the Joint Chiefs of Staff.

Military-Type F-27 Offered by Fairchild

A military-type cargo version of the F-27 is being offered by Fairchild Engine and Airplane Corp. to Defense Department for immediate delivery. Advance planning, under the proposal, would call for rear-loading or Short Take-Off and Landing versions of the plane.

A proposal for a military executive version of the plane was turned down by Air Force last year.

Using Rolls-Royce Dart-8 engines, the existing version of the plane is a standard F-27, fitted with side-loading cargo doors. Payloads for the plane would be in the five or six ton range, with gross weight set at 38,500 lbs. Price-tag on the heretofore commercial aircraft runs about $1-million per copy.

NATO Supply Center Gathers Headway

First shipments—some $9-million worth—of aircraft spares to Germany, France and Italy were made early last month from the new NATO Supply Center, Chateroux, France (see Dec. 1959 AFM). The new center was set up among the NATO nations as an international logistics cooperative, with an eye to lowered costs and greater efficiency.

Early efforts of the Center will concentrate on support for the F-84, F-86, C-47, C-119 and T-33 aircraft. Other types will come under the system as necessary. Also, the center provides support for Nike and Honest John.

Major center activities will center on maintenance, supply, procurement and technical assistance services for the systems supported.

Needs Set by Air Force On Engineering Data

Nine documents setting forth Air Force requirements for micro-reproduction of drawings, associated lists and related data have just been released by Headquarters, Air Materiel Command.

Move is a follow-on to Defense approval and release of these documents in line with the Engineering Data Micro-Reproduction System. The new documents, according to an AMC source, will "provide industry with uniform systems and procedures for furnishing engineering data for items procured by the Army, Navy and Air Force.

All Air Force contractors are now required to furnish: (1) one set of 35 mm roll microfilm, (2) one punched card for each numbered sheet of data in a complete set for an item; (3) one punched card for each frame of microfilm; and (4) one punched card for each vendor item in the contractor's equipment. In some cases, the Army and Navy requirements may be different than those of the Air Force.

The new documents will replace about fifty Army, Navy and Air Force documents that hitherto have provided separate ways of doing business for each service. Armed Forces Supply Support Center monitors the program for Defense Department.

Newsletter

Armed Forces Management Association
Washington 25, D.C. Phone: OTis 4-7193

National President: Hon. George H. Roderick **Exec. Vice Pres.: VAdm. Harry E. Sears, USN, ret.**

Annual Report

Background—Two years ago your association embarked on an ambitious program of expanded operations and services under guidelines established by its newly elected president. Principal in this program was the appointment of a full-time executive, who took office on 15 August, 1958.

Results of the new program continue gratifying. The Association has enjoyed another very successful year. Despite extraordinary expenses for equipment, printed materials and postage, finances are in excellent shape and our cash position has shown a modest growth. Membership continues to expand. The stature of our national officers and Board of Directors is impressive. The Association daily is becoming better known, and is acquiring an enviable reputation for its contributions to Defense and industry management, and its services to its membership.

We have a number of new and important chapters. Our recent national conference was the best in our history. Most important, AFMA is becoming better known, not only in name but as an organization rendering real service to our national defense effort.

This record of achievement is the result of much hard work on the part of people in the organization, and the fine support we continue to receive from the Secretary of Defense and the Services. We appreciate greatly this confidence in our objectives and program, and will do our utmost to merit this trust. Our joint efforts toward management improvement at all levels, we are convinced, will give us a better defense while effecting savings worth many millions of dollars. This is a real challenge in these troubled times and one we accept with confidence.

Review of Progress

A review of AFMA progress in the various functional fields for Fiscal '60 includes:

Programs—The fine program formulated by our former vice president in this area, Vice Admiral E. W. Clexton, continues as a valid guide for present and future operations.

In addition to the many improvements in our program carried in last year's report, the following additional one has been made: liaison with other national organizations in areas of common interest with AFMA have been greatly developed, particularly at the chapter level.

Chapters—The Chapter Manual has been completed and distributed. This represents a milestone in the AFMA evolution, as this guide book contributes greatly to simplified chapter formation, programing and administration.

A new poster/application holder for bulletin boards has been developed to stimulate membership. Supplies of these are being sent to all chapters, embryo chapters, and major installations. Additional combinations are available on request.

Membership in all major categories increased during the year: Individual, 33%; Corporate (industry), 25%; Chapters, 25%. Membership accounting is now on a sound basis. All delinquent members, after suitable warning, were dropped before the close of the fiscal year.

New chapters have been formed at SAC Headquarters, Army Diamond Ordnance Fuze Laboratory, Naval Weapons Plant, and Westover, Travis and Eielson Air Force Bases. Over twenty requests to form new chapters are in hand at national headquarters.

Publications—ARMED FORCES MANAGEMENT magazine, which serves as a vehicle for our *Newsletter,* continues to grow in stature and popularity. We would welcome management type articles for printing in this fine periodical. The AFMA JOURNAL likewise continues to improve, and serves as a compendium and valuable reference of the national conference proceedings.

As a service to our industry members, we are forwarding to them interesting management ideas as they come across our desk from time to time.

National Conference—It is the consensus of opinion of those in attendance that this year's national conference, held outside of Washington for the first time, was an outstanding event. Much was learned from the "Atlanta Experiment" which will serve to make future meetings even better. An innovation this year, at the suggestion of the Fort Benning Chapter which monitored the program, was a chapter workshop session in a number of selected areas. From these workshops evolved many suggestions for the overall improvement of chapter operations.

Plans—The constant improvement of the program is in the forefront of all AFMA plans. To this end ideas and suggestions from all sources are welcomed, and will be carefully evaluated for possible use. For the coming year, we would stress membership growth, to give us a firm base upon which to expand our services. We need new members, new chapters and new corporations to fully meet our objectives. We feel that in helping defense managers at all levels to improve our national defense through better management—be these managers in the Services or in industry —we have one of the finest objectives of any association in the country. The help of our members and our friends everywhere in stimulating membership growth will be a real service to our country and the individuals concerned.

Next year's national conference will be held in Washington, date and place to be announced soon.

In order further to simplify chapter administration, it has been suggested that all billings for national dues be done from headquarters. We would welcome comments and suggestions from the chapters on this proposal.

Chapter Briefs

Chapters are reminded that programing for the new fiscal year should be well along by now. Refer to Chapter Manual for ideas on how to develop a program that will be of interest and value to the whole membership. Remember that chapters to be eligible for the national best chapter award must conduct a required number of meetings or the equivalent during the year. Also, don't forget to forward required information at specified intervals to qualify for the competition, which promises to be especially keen this year.

A number of chapters have elected new officers for the coming year. Unfortunately, these are too numerous to print in this edition, but we do wish to acknowledge these people, to congratulate them on their election, and to wish them a rewarding experience in the year ahead. Your national headquarters and your chapter mates are grateful for your service to our growing organization.

The Fifth of Fourteen Erroneous Postulates

5—Collective human effort is unified as an organization by leadership.

by Leland B. Kuhre, Col., USA (ret.)*

Founder and Director
The Academy of Organizational Science

The postulate is erroneous as a starting assumption from which to form and operate the true organization of collective-human-effort-for-a-purpose.

Generalizations on 'leadership' are many: leadership is a totality of personality-traits . . . impress your personality on the organization . . . any organization will work with good leadership . . . and so on. Age, repetition, and prestige-utterance implant primacy of leadership in mind with postulate-weight, often in unawareness; this primacy appears to prevail today. However, there are three primacies: authority, personality-leadership, and purpose. Where one is primary, others are complementary.

Leadership is "ability to lead." *Lead* appeared in the 16th century from words meaning *road, journey, to go, travel.* Today's usages are not literal, for example: "to lead by the nose" and "to direct by one's example."

It is implicit in the postulate that its holder uses personality-forces, directly or through delegates, to cause human beings to work together. To achieve unity efficiently, interdependent individual functioning must be predictable; or else trial and error will waste time and energy.

But the postulate-holder cannot predict because he has unknowns to predict from; he does not know what *human being* is. From variously ascribed components—body, brain, mind, soul, spirit—he makes his governing selection according to the influences, usually indirect, of many schools of thought in philosophy, religion, and social science, and of *isms* such as naturalism, materialism, existentialism, behaviorism, and so on.

Conjecture or Fact?

For example, from many authorities in the literature we have prevailing concepts of the human being such as "animal" or "product of stimuli" or "stream of consciousness" and so on. The only general agreement is that each human being is unique; he is unpredictable; others see him as he *appears to be*—what he exhibits—his personality—not what he *is*. In so-called organizations where personality governs, persons can be expected to exhibit personality-traits for a calculated effect.

Consequently, in any situation, the postulate-holder must use a collection of conjectures, and, with them, contrive to unify a collection of *persons* as an organization of unpredictables.

But true organization—dynamic system—is an assemblage of *things*, connected, associated, or interdependent, so as to form a complex unity for a definite purpose. *Thing* is an inanimate object, or the object of thought, knowledge, or perception; it is not an unknown.

Things (knowns) can be organized; persons (unknowns) cannot. Therefore the postulate is erroneous.

To predict true organization, we must postulate primacy of purpose and express purpose as a decision-contract for the planned life of the organization. From this contract, logical deduction generates all needed individual decision-contracts for both mental and physical effort, and, concomitantly, connects the contracts in a system of relations.

The Crucial Choice

A contract is a definite thing. Thus we have an organization of things—a system—a set of individual contracts so connected as to form a complex unity for a definite purpose. Inherent in *system*, and predictable, are stability, continuity, harmony, efficiency, and effectiveness for its purpose.

Each contract activates a person; it is uniquely his; and it gives him definite functional relations with adjacent contracts and with the whole organization of contracts.

Today's commonly used and known-to-be-dependable force in sanctity of contract owes over a century of explosive growth in the U.S. to its successful prediction of mutual performance in, for example, construction, manufacture, purchase, buy-now-pay-later, product guarantee, athletic team positions, research, and so on into all human activity, intellectual as well as physical. In the contract-system-organization of collective human effort, this same force causes persons to make their contract-called-for contributions to the organization's purpose, and to expect system-certain rewards and penalties accordingly.

There is a fork in the approach-road to organized collective human effort. One branch tries to organize *humans* with trial and error; the other branch actually organizes human *efforts* with prediction. A crucial choice.

* *Author Kuhre can be contacted at P. O. Box 5274, San Antonio 1, Texas.*

WHO SAID WOMEN AREN'T SMART?

In a recent Broadway comedy called "The Girls In 509," the audience met two whimsical ladies who are about to be evicted from their apartment for nonpayment of rent. They are destitute—or so they think.

Yet it turns out that their walls are papered with 30,000 shares of General Motors stock, which they innocently thought had no value. When the curtain falls on this cheery foolishness, they find they are worth millions.

Since the ladies haven't set foot out of their rooms for about 25 years—they haven't read a newspaper and don't even know what television is—perhaps they can be excused for their ignorance. But surely there are many women around nowdays who would be so in the dark.

The blunt fact is that women constitute a sizeable and informed portion of the investing public. And there are thousands of them who can discuss "investment objectives," "dividend yields," and "growth stocks" with the best of the males.

According to the New York Stock Exchange's most recent census, for example, more than 52 per cent of American shareowners were women. By the numbers, that's 6.3 million women.

Many skeptics may say they inherited the securities from their families or their husbands. Of course a number of them did. But impressive numbers of career girls and housewives acquired their nest-egg of securities by investing on a regular basis from current income. America's average female capitalist, in fact, has an annual family income of $7,000.

The folklore of investing may be peopled with sweet old ladies who toss away $1,000 bonds despite their face value, simply because "the coupons have all been used up." But fact seldom imitates fiction. Although these tales are humorous enough, by and large the women they describe went out with the bustle.

Any broker will tell you that most women investors take their responsibilities seriously. They have learned to understand the risks involved and they want the facts before buying or selling. A number of female shareowners startle even experienced brokers with their knowledge and curiosity.

"I wouldn't think of buying stock without fully exploring the possibilities with my broker first," an attractive young housewife in Western Springs, Illinois recently commented. "I want to know the company's earnings, its competitive position, its future prospects, everything else that I can."

Women generally shop for good securities with just that sort of lively interest. They often review annual reports, go through financial statements, and call on brokers for detailed information about companies they're interested in. In Boston, a career girl buying shares of a chemical company went so far as to telephone the company president and ask him why more funds didn't go into research. The surprised and impressed executive satisfied the young lady that the company was indeed earmarking sufficient sums for research and product development.

Individually, women do make intelligent investors. They are gradually bringing their influence to bear through group action as well. Many belong to investment clubs which had beginnings over bridge tables, and there is a growing number of study groups sponsored by women's clubs to acquaint ladies with the rudiments of the investment process.

What's more, women in exciting numbers are going into the field of finance itself. Brokerage houses virtually everywhere can point to a woman as a successful broker. A few have risen to become top executives of important firms.

Some of our women readers are probably asking an obvious question: "Well, what's so surprising? Why shouldn't women take an interest in investing?"

The truth is it isn't really surprising at all. To paraphrase an old bit of wisdom, it's good to have further proof that the hand that rocks the cradle is apt to contain an annual report.

Mismanaging the moron . . .

(continued from page 23)

These same observations have been noted by other officials concerned with top level ADPS management. One area, which defense has taken a nationwide lead in doing something about, is the development through a joint government-industry effort of a common language for programming computers. Says Phillips, "the writing of detailed machine instructions (called 'programming') is one of the most expensive and time consuming jobs in installing ADP. In our evaluations we invariably find programming is the major problem and it is usually a factor in underestimating costs and time requirements."

The Common Language

Rather than standardize on machinery, a solution which has been analyzed a good deal in that business, defense has led the way in an attempt to standardize on the programming language. Said one official, "Standardizing on machinery right now would be about the same as standardizing automobiles on a 1905 model."

The result, whose first volume will be out this month, is COBOL—for COmmon Business Oriented Language.

First step has been to come up with a language quickly, but one which is reliable, couple this with a development (by computer manufacturers) of the necessary compilers or automatic coders which will translate COBOL into the language their separate machines now use. A refinement of the language will be the next step. Updating and revising the basic COBOL language manual will be a continuing job and a tough one. Example: There will probably be more page changes next year and a half than there are in the first COBOL volume.

But the effort will be worth it. The flexibility in rental or purchase of manufacturers' equipment is one thing. (The one item which more than any other keeps people from switching equipment is the re-programming cost. Another factor: economy. Defense estimates it spent, conservatively, over $35-million last year on programming, believes COBOL could save up to 40% of its present programming time on jobs using automatic techniques.

First language is oriented to the professional programmer. Says Phillips, "We hope to refine it so it can be used with equal facility by the systems analyst and be readily understood by the manager. One of our major long range objectives is to provide the manager with the means of knowing through his own review of the program what the computer is actually doing rather than relying on a technician to interpret the steps of a business problem in machine language."

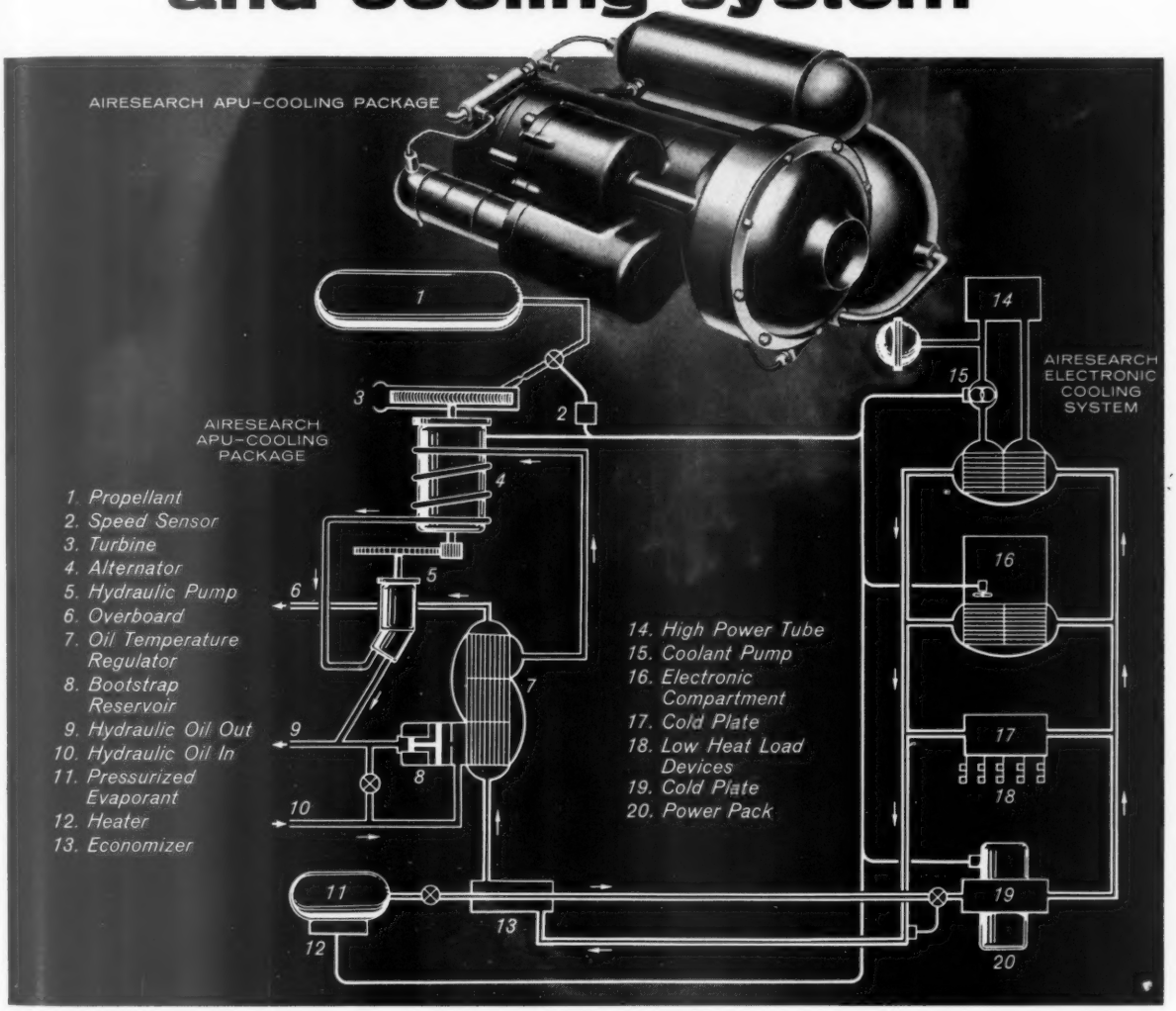
In summation: A careful analysis of the many specific evaluation reports coming out of the Pentagon on the use of EDPS indicates that there has been a considerable amount of progress —far more than defense is frequently given credit for. Not only is defense ahead in money, talent and resources being expended in the field, they also show considerable talent in creative uses of ADP and insistence on equipment improvement.

But their major weakness appears to be in the management of this whole revolution. The gap: a failure by managers in the field to realize that the computer is not a panacea, actually increases the demands on outstanding managerial talent. Developments in hardware have forged ahead of the needed parallel improvements in "software"—that is, our computer capabilities generally exceed management's abilities to use them most effectively.

Said one computer operator, "It seems a lot of the people who are so eager to keep up with the parade and buy one of these marvelous electronic setups—apparently because they think it can do everything and do it a thousand times faster than any human being—seem to forget that these mechanical brains are so intelligent they can't and won't do anything except just exactly what they are told—a trait they have in common with most morons."

Advertisers' Index

Integrated accessory power and cooling system



meets the most advanced missile and space vehicle requirements

AiResearch has developed a *single* system package for missiles and space vehicles to meet increasing accessory power and cooling load requirements in the face of decreasing size and weight allowances.

This integrated accessory power and cooling system supplies hydraulic power for actuating systems, 3200 or 400 cycle three-phase electric power for guidance and control, and at the same time provide cooling both for the APU and all electronic equipment operating in the missile or space vehicle.

The cooling system in the example shown here uses liquid ammonia as the expendable evaporant, and each heat load area has a separate temperature control valve. Alternator and controls, turbine assembly and APU liquid propellant fuel tank are patterned after operationally proven components.

World leader in the design and manufacture of cooling and accessory power systems, AiResearch has delivered more missile APUs than any other company, and is the leader in advanced electronic cooling systems for aircraft, missiles and spacecraft.

AiResearch design and manufacturing experience in these two fields includes: liquid and solid propellant APUs; hydraulic and hot gas actuators and control systems; 3200 and 400 cycle alternators; cold plates; expendable and closed cycle gas and liquid cooling systems; cryogenic cooling systems.

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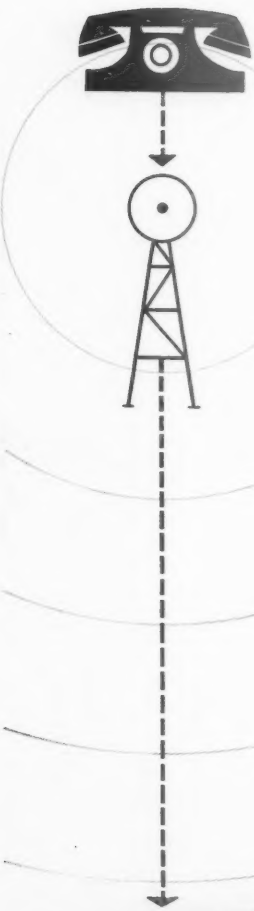

The U.S. Army Corps of Engineers is using Stromberg-Carlson—San Diego's new S-C 3000 High Speed Communications Printer to print 3000 words a minute from remote sources. The equipment can print out over great distances, using standard wire or radio links.

The S-C 3000 is compatible with most available data link systems, including the Collins Kineplex data transmission system and the Stromberg-Carlson Binary Data Link. Printing is accomplished through a unique combination of the Stromberg-Carlson CHARACTRON® shaped beam tube and Haloid Xerox, Inc's., electrostatic printing process. The S-C 3000 prints without impact on untreated paper or lithographic masters.

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